STAR

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

FEBRUARY 23, 1971

VOLUME 9 • NUMBER 4

N71-1346[illegible]00

PUBLIC [illegible]

MAR [illegible] 1971

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Scientific and Technical Aerospace Reports, Volume 9, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966.

INTRODUCTION

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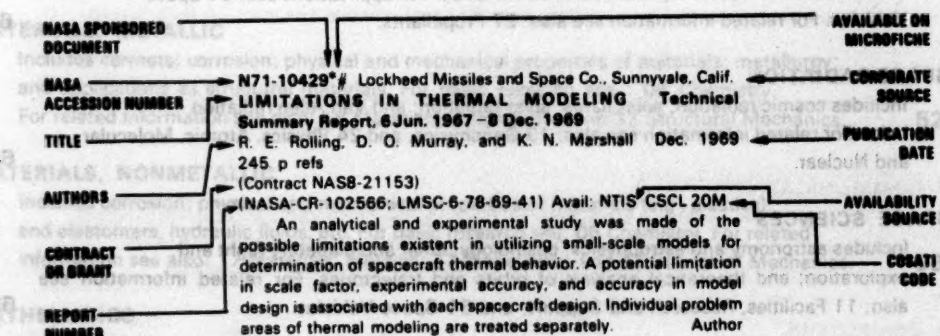
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R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
PUBLICATION DATE
245 p refs
AUTHORS
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
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VOLUME 9 NUMBER 4 / FEBRUARY 23, 1971

Scientific and Technical Aerospace Reports

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-13401# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

INCIDENCE AND BLUNTNESS EFFECTS ON THE AERODYNAMIC CHARACTERISTICS OF A FLAT PLATE IN A STRONG INTERACTION REGIME [EFFECTS D'INCIDENCE ET D'EMOUSSEMENT SUR LES CARACTERISTIQUES AERODYNAMIQUES D'UNE PLAQUE PLANE EN REGIME DE FORTE INTERACTION]

Jean Allegre and Georges Herpe May 1970 53 p refs In FRENCH; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais
(Rept-70-4; Publ-372) Avail: NTIS

After discussing incidence and leading edge bluntness effects, wall pressure and heat transfer distributions along flat plates are compared with strong interaction regime theory. Components of aerodynamic forces due to the wall pressure only were compared with total aerodynamic force values to obtain the skin friction effect for various flat plate configurations. Data were obtained in a Mach 8 rarefied hypersonic flow with a free-stream Reynolds number of 2200 per cm; viscous interaction parameters along the plates varied between 4 and 15. Author (ESRO)

N71-13402# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PRECISE CALCULATION OF UNSTEADY AERODYNAMIC PRESSURES IN SUBSONIC FLOW [CALCUL PRECIS DES PRESSIONS AERODYNAMIQUES INSTATIONNAIRES EN SUBSONIQUE]

Pierre Selaun 1970 34 p refs In FRENCH; ENGLISH summary
(ONERA-NT-163) Avail: NTIS

The aerodynamic pressures on a rectangular wing vibrating in subsonic flow were calculated by the integral equation method, in which the pressure and the right hand member were developed in limited series of orthogonal polynomials thus replacing the integral equation by a system of linear equations. Aerodynamic coefficient matrices are presented for aspect ratios 1 and 3, Mach numbers 0.5 and 0.7, and reduced frequencies 0.5 and 2. Author (ESRO)

N71-13403# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

EXPERIMENTAL STUDY OF THE WAKES OF CYLINDERS AND SPHERES IN LOW DENSITY HYPERSONIC FLOWS [ETUDE EXPERIMENTALE DU SILLAGE DE CYLINDRES ET DE SPHERES EN ECOULEMENT HYPERSONIQUE DE GAZ RAREFIE]

Henri Coudeville and Michel Raffin Dec. 1969 98 p refs In FRENCH; ENGLISH summary Sponsored in part by DRME
(Rept-69-7; Publ-369) Avail: NTIS

Sphere and cylinder wakes were studied in low density supersonic and hypersonic flows. The Knudsen numbers, based on the diameters, ranged from 0.01 to 10 for Mach numbers of 4, 8 and 20. Wake structure was characterized by the bow shock wave intensity and thickness, and also by the existence or absence of a trailing shock wave. Comparison of the wake configurations of cylinders and spheres provided a reference length for accurate definition of the Knudsen number. Author (ESRO)

N71-13404*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

AN EXPLORATORY AERODYNAMIC AND STRUCTURAL INVESTIGATION OF ALL-FLEXIBLE PARAWINGS

J. N. Nielson, S. B. Spangler, S. S. Stahara, and A. L. Lee Washington NASA Dec. 1970 160 p refs
(Contract NAS1-8477)
(NASA-CR-1674; NEAR-TR-20) Avail: NTIS CSCL 01C

A theoretical investigation was made of the aerodynamic and structural aspects of all-flexible parawings. These wings are characterized by large amounts of spanwise camber. An aerodynamic method was developed through the use of slender-body theory to account for the principal nonplanar effects. The method considers sections in the plane normal to the root chord to be circular arcs which may translate and dilate with distance along the root chord. The method yields spanwise and chordwise distributions of loading, the distribution of suction along the leading edge and the induced drag. Various static equilibrium models were examined for the purpose of determining the canopy tension distribution and rigging line loads. The methods were applied to a single- and a twin-keel parawing for which data on inflated shape, overall aerodynamic loads, and line loads were obtained. Comparisons with these load data were made using the measured canopy shapes. Author

N71-13405*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

AN EXPERIMENTAL INVESTIGATION OF PANEL DIVERGENCE AT SUBSONIC SPEEDS

Thorsteinn Gislason, Jr. Jul. 1970 57 p refs
(Grant NGR-31-001-146)

(NASA-CR-111821; AMS-921) Avail: NTIS CSCL 20D

Panel flutter and panel divergence were investigated as structural aeroelastic problems which lead to fatigue failure. The boundary conditions and thickness of a clamped aluminum panel with a chord to span ratio of 2 in a low Mach number flow regime were studied with the temperature effects, aerodynamic loading and divergence. The conclusions are: (1) A technique has been developed to determine divergence behavior. (2) Post-divergence strain response is essentially as predicted by the linearized potential theory. (3) Divergence occurs at the dynamic pressure that linearized potential theory and a one mode Galerkin solution idicates. (4) Sag and the corresponding curvature of panels greatly increases the post-divergence strain response of thin panels. F.O.S.

N71-13406# National Physical Lab., Teddington (England). Fluid Motion Subcommittee.

THE BEHAVIOUR OF THE LEADING-EDGE VORTICES OVER A DELTA WING FOLLOWING A SUDDEN CHANGE OF INCIDENCE

N. C. Lambourne, D. W. Bryer, and J. F. M. Maybrey Mar. 1970 57 p refs

(NPL-AERO-1294) Copyright. Avail: NTIS

The transient behavior of leading-edge vortices over a delta wing subject to a sudden change of incidence is studied to understand the wing loadings that can occur in unsteady conditions of flight. In the experiments reported, changes of incidence have been imposed on delta-shaped plates by application of a constant-velocity plunging motion for a limited time; other related unsteady motions are also discussed. Results indicate that after the start of the plunge an effectively steady vortex system established over the plate in a time approximately equal to that required for one chord length of relative forward travel. Where comparisons can be made, Dore's theoretical calculations of the manner in which the vortices move show fair agreement with the experiment. Effects of the transient movements of the vortices on lift distribution are disucssed and the inference is drawn that the changes in the distribution of wing loading occurring for an increase of incidence are not simply reversed when the incidence is decreased. Author

N71-13407# Weapons Research Establishment, Salisbury (Australia).

THE USE OF RATE GYROSCOPES IN THE FREE FLIGHT MEASUREMENT OF AERODYNAMIC LATERAL FORCE AND MOMENT COEFFICIENTS

N. E. Gilbert Mar. 1970 38 p refs

(WRE-TN-HSA-164) Avail: NTIS

Suitable flight data regions were selected for the free flight measurement of aerodynamic force and moment coefficients on two bombs, each with four fins. The bombs carried an incidence meter, three rate gyroscopes, and four linear accelerometers. The flight data is fitted to a mathematical model of the force and moment system developed by Maple and Synge. Pitch and yaw rates and pitch and yaw accelerations derived using rate gyroscope measurements are compared with those derived using other sources and the agreement was found to be very good. Static coefficients are found to be equally well obtained using any of the various combinations of rate gyroscope and linear accelerometer measurements. Results are given at a Mach number of 0.6 and very good agreement is obtained between free flight and wind tunnel measurements of the static forces and moments. However, satisfactory free flight measurements of Magnus coefficients and damping coefficient derivatives were not obtained. Because of inadequate instrumentation and uncertainties in rate gyroscope measurement of roll rate, no data were obtained on axial forces and moments. Author

N71-13408# Oxford Univ. (England). Engineering Lab.

EXPERIMENTAL STUDIES OF HYPERSONIC BOUNDARY LAYER TRANSITION

John. E. LaGraff (Ph.D. Thesis) May 1970 281 p refs Sponsored by Min. of Technol.

(Rept-1104/70) Avail: NTIS

The design, instrumentation, and calibration of the Oxford hypersonic gun tunnel and measurements of boundary layer transition on the outside surface of a hollow cylinder model using shadowgraph and surface pitot techniques are described. Transition experiments on the model in various European wind tunnels are compared and a correlation based on nozzle wall boundary layer aerodynamic noise radiation is discussed. Heat transfer measurements on the surface of a 10 deg total angle sharp cone and a flat plate were made and compared with theoretical predictions. Strong flat plate fluctuation intensities, due to large turbulent eddies generated near the model leading edge and initially located in the boundary layer, were found within the boundary layer upstream of the region where transition began. Author (ESRO)

N71-13409# National Physical Lab., Teddington (England). Aerodynamics Div.

AN INVESTIGATION OF THE EFFECTS OF UNIT REYNOLDS NUMBER AND INCIDENCE ON BOUNDARY-LAYER TRANSITION IN THE NPL 6 INCH BY 6 INCH SUPERSONIC WIND TUNNEL

P. G. Pugh and D. F. Bedder 16 Sep. 1969 24 p refs

(NPL-AERO-1301; ARC-31382) Copyright. Avail: NTIS

Tests made in the NPL 6 in x 6 in tunnel at M = 3.0 to determine the effects of unit Reynolds number and incidence on boundary layer transition on a right-circular cone model are reported. The importance of residual steady-state convective heat transfer is highlighted. A simple prediction method is outlined and shown to account for the quantitative effects of incidence. Author

N71-13410* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MINIMUM INDUCED DRAG AIRFOIL BODY Patent

Clarence D. Cone, Jr., inventor (to NASA) Issued 6 Sep. 1966 (Filed 26 Dec. 1962) 8 p Cl. 244-35

(NASA-Case-XLA-00755; US-Patent-3,270,988; US-Patent-Appl-SN-247423) Avail: US Patent Office CSCL 01A

An electric analog apparatus for measuring the induced drag of a wing form is described for studying means of reducing the induced drag of conventional wings. The analog of the fluid flow pattern is provided by setting up an electric field in a conductive sheet and forming a nonconductive void in the sheet shaped like the wing form. Measurements of potential differences between points on opposite sides of the void are taken. Applications of the electric analog to the analysis of nonplanar wing configurations are given. N.E.N.

N71-13411* National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.

MINIMUM INDUCED DRAG AIRFOIL BODY Patent

Clarence D. Cone, Jr., inventor (to NASA) Issued 10 Mar. 1970 (Filed 30 Sep. 1965) 9 p Cl. 235-61.6; Int. Cl. G06k15/00 Continuation-in-part of US Patent Appl. SN-247423, filed 26 Dec. 1962

(NASA-Case-XLA-05828; US-Patent-3,500,020; US-Patent-Appl-SN-509460) Avail: US Patent Office CSCL 01A

Additional claims are presented for the electric analog (for abstract, see N71-13410 04-01). These claims concern the efficacy of the device in predetermining the specific nonplanar wing configuration having minimum induced drag. N.E.N.

N71-13583*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AERODYNAMICS OF BODIES FROM MOTION ANALYSIS

Gary T. Chapman, Donn B. Kirk, and Gerald N. Malcolm *In* AGARD Ballistic Range Technol. Aug. 1970 p 267-348 refs

(See N71-13576 04-11)
(NASA-TM-X-66536) Avail: NTIS CSCL 20D

Several techniques for determining the aerodynamic characteristics of bodies in free flight in a ballistic range are examined. Since the measurements from which the aerodynamics are to be deduced usually consist of angular and linear position data from photographic records of a model in flight, discussion is restricted to the analysis of angular and linear position data as functions of either time or distance traveled. Following a discussion of the different coordinate systems used in analyzing free flight data, the differential equations of motion are derived by considering several ways of writing the equations for flight dynamics and combining these with appropriate expressions for the applied forces and moments. The various techniques for deducing drag, static and dynamic stability, lift, and rolling moment coefficients from the measured data are discussed and examples are presented. Also included is a section on error analysis and an appendix treating the method of least squares using differential corrections. A.L.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-13412*# National Aeronautics and Space Administration, Washington, D.C.

RECENT WORKS ON AIRCRAFT-PRIMARY CONTROL AT THE DFL INSTITUTE FOR AIRCRAFT GUIDANCE [NEURE ARBEITEN ZUR FLUGZEUG-PRIMAERSTEUERUNG AM INSTITUT FUER FLUGFUEHRUNG DER DFL]

W. Metzdorff Dec. 1969 20 p Transl. into ENGLISH from German report DFL-B p 393–404
(NASA-TT-F-12709; DFL-B) Avail: NTIS CSCL 01C

Research was conducted at the DFL Institute for Aircraft Guidance in order to study the characteristics and applicability of digital electrohydraulic systems in flight control. Author

N71-13413# Southhampton Univ. (England). Inst. of Sound and Vibration Research.

THE TRANSMISSION OF SONIC BOOMS SIGNALS INTO ROOMS THROUGH OPEN WINDOWS. PART 3: EXPERIMENTAL WORK AND GENERAL DISCUSSION

P. G. Vaidya [1970] 2 p refs
Avail: NTIS

Results of some full scale experiments, carried out by using simulated sonic booms, are presented. These results were compared with the predictions obtained previously. A general theoretical description of the buildup of the acoustic field inside a room due to a transient incident onto an open window was developed in detail. Possible extensions of the theoretical analysis are indicated in the Appendix. Author

N71-13414# National Research Council of Canada, Ottawa (Ontario).

FUELS AND LUBRICANTS SECTION. AIRCRAFT CARBURETOR ICING STUDIES

L. Gardner and G. Moon Jul. 1970 41 p refs
(LR-536) Avail: NTIS

A study was made of the effect of gasoline icing inhibitors on aircraft carburetor icing. An engine test was developed and used to evaluate various types of inhibitor. The results obtained showed that aircraft carburetor icing can be prevented by the inclusion of additives in the gasoline. The use of a teflon-coated throttle plate to prevent ice adhesion was studied and found to virtually eliminate any ice formation on the plate. The use of ethylene glycol monomethyl ether at 0.10 - 0.15% by volume in the gasoline and teflon-coated plate was shown to prevent both carburetor and fuel system icing. Author

N71-13415# Cranfield Inst. of Technology (England).

AIRCRAFT DESIGN STUDIES: COUNTER INSURGENCY AIRCRAFT WITH SUCTION BOUNDARY LAYER CONTROL

D. Howe Apr. 1970 40 p refs
(Aero-1) Avail: NTIS

A design study of a counter insurgency aircraft with a suction boundary layer controlled wing to give high lift was undertaken. The aircraft has a gross weight of 9800 lb, and was designed to carry a variety of payloads of up to 2000 lb. at a maximum speed of 380 mph. The flight usable lift coefficient of five is achieved at an incidence of approximately 30 deg, which introduces particular layout and undercarriage problems. A twin boom configuration with a variable geometry undercarriage was adopted. It is concluded that the use of a suction boundary layer control system will confer significant performance benefits, but the aircraft might well be handicapped by climatic operational limitations. The variable geometry undercarriage is complex and an alternative layout using a tilt wing is recommended. Author

N71-13416# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: LEHIGH ACRES DEVELOPMENT, INCORPORATED, MARTIN 404, N40412, ATLANTA, GEORGIA, 30 MAY 1970

30 Sep. 1970 17 p refs *Its* File No. 3-0757
(NTSB-AAR-70-25) Avail: NTIS

Results from an investigation of the Martin 404, N40412 are given. It was determined that probable cause of the accident was loss of effective engine power due to improper fuel being placed in the tanks. A contributing factor was that the flight crew did not detect the error. It was recommended that a more accurate color coding system for tank fuels be used; refueling nozzles be marked; parts of safety rules 23, 25, 27, and 29 be modified; and existing aircraft be required to be painted within a year after publication of the changes. E.H.W.

N71-13417# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: SEABOARD WORLD AIRLINES, INCORPORATED, DOUGLAS DC-8-63F, N8634, STOCKTON METROPOLITAN AIRPORT, STOCKTON, CALIFORNIA, 16 OCTOBER 1969

30 Sep. 1970 28 p refs *Its* File No. 1-0058
(NTSB-AAR-70-24) Avail: NTIS

Results from an investigation of the Douglas DC-8-63F, N8634 crash are given. It was determined that probable cause of the accident was a false ground spoiler position indication during the takeoff portion of a touch-and-go landing that induced the captain to discontinue the takeoff at a point too far down the runway to permit him to stop the aircraft on the runway. It was recommended that the Federal Aviation Administration take the required action to insure that an apparate warning be included in all DC-8 operations manuals which states that: The ground spoiler selector lever shall be manually positioned to the spoiler extend setting on all rejected takeoffs, regardless of ground spoiler light indications. Author

N71-13418# Federal Aviation Administration, Washington, D.C. Information and Statistics Div.

MILITARY AIR TRAFFIC ACTIVITY REPORT: CALENDAR

YEAR 1969
Viola W. Patterson Jun. 1970 52 p refs
(Rept-70-10) Avail: Issuing Activity

Air traffic activity for calendar year 1969 is reported by U.S. Air Force Bases, Army Airfields, and Naval Aeronautical Facilities in the United States and Oversees. In addition, data on Naval instrument operations, VFR operations, and instrument approaches are presented. Author

N71-13419*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
VALIDATION OF THE GAS GENERATOR METHOD OF CALCULATING JET-ENGINE THRUST AND EVALUATION OF XB-70-1 AIRPLANE ENGINE PERFORMANCE AT GROUND STATIC CONDITIONS
Henry H. Arnaiz and William G. Schweikhard Washington Dec. 1970 45 p refs
(NASA-TN-D-7028; H-596) Avail: NTIS CSCL 01A

Deficiencies in established techniques of measuring aircraft thrust in flight led to the application of the gas generator method of calculating engine thrust to the XB-70-1 airplane. A series of tests on a ground static-thrust stand was performed on the airplane to establish at ground static conditions the accuracy of this method, to measure the installed thrust of the YJ93-GE-3 engine, and to determine the effect of instrumentation errors and nonuniform flows at the engine compressor face on the thrust calculation. Tests with an aerodynamically choked inlet, an opened inlet-bypass system, and varying combinations of operating engines were also conducted. Results showed that the accuracy of the gas generator method was + or − 2 percent for the normal operation of the XB-70-1 airplane at ground static conditions and for the upper 70 percent of the engine's throttle range. They also showed that the effect of individual instrument errors on the thrust calculation was reduced because of the large number of measurements and that abnormally high inlet flow distortion affects the thrust calculation. When corrected for inlet losses, the installed thrust of the YJ93-GE-3 engine agreed favorably with the engine manufacturer's uninstalled estimated thrust for all power settings except those at the low end. Author

N71-13420# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REINGESTION CHARACTERISTICS AND INLET FLOW DISTORTION OF V/STOL LIFT-ENGINE FIGHTER CONFIGURATIONS
Jerry V. Kirk and Jerry P. Barrack Washington Dec. 1970 44 p refs
(NASA-TN-D-7014; A-2996) Avail: NTIS CSCL 01A

Reingestion of exhaust gas into engine inlets during hover, and inlet flow distortion with the associated loss in total-pressure recovery during transition were studied using a large-scale generalized lift-engine fighter model powered by J-85 engines. Exhaust gas reingestion during hover was studied on a static test facility, and inlet flow distortion and total-pressure recovery loss were studied in the 40- by 80-foot wind tunnel. Two lift-engine arrangements were studied, the swiveling, retractable and the internally fixed. Both arrangements were subject to excessive thrust loss and compressor stalls due to reingestion when the engine exhaust was vectored nearly vertical. Vectoring the exhaust approximately 20 deg from vertical essentially eliminated reingestion problems. Vectoring the lift-engine exhaust forward and the lift-cruise engine exhaust aft to balance the aircraft and minimize reingestion appears to be a feasible means of allowing VTOL operation. Inlet flow distortion and total-pressure recovery were within acceptable limits for the swiveling, retractable lift-engine configuration. With the inlet guide vane installed to help turn the flow into the engine, the vertically mounted lift engines of the internally fixed configuration with an inlet radius to diameter ratio of 0.19 produced acceptable inlet flow distortion and total-pressure recovery results. Without the guide vane the nominal acceptable distortion level of 10 percent was exceeded at the higher velocity ratios. Author

N71-13421* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ENERGY MANAGEMENT SYSTEM FOR GLIDER TYPE VEHICLE Patent
Roger L. Winblade and John P. Smith, inventors (to NASA) Issued 28 Jun. 1966 (Filed 24 Jun. 1962) 14 p Cl. 235-150.22
(NASA-Case-XFR-00756; US-Patent-3,258,582;
US-Patent-Appl-SN-212173) Avail: US Patent Office CSCL 01B

A data processing and display system is described for use as terminal guidance or energy management apparatus on X-15 or DynaSoar vehicles. Real time in-flight total range capability of the vehicle is presented in a graphical display which continuously outlines the possible landing area. The method is based on the empirical fact that the landing area on an assumed flat earth as seen from above is a modified cardioid ahead of the aircraft, with the cardioid valley closest to the aircraft. The area is a function of the vehicle's location, heading, velocity, and altitude, and these data are fed to a special purpose computer. The computer generates voltages applied to an oscilloscope which in turn displays the size and position of the cardioid relative to the map overlay. N.E.N.

N71-13422* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MECHANICAL STABILITY AUGMENTATION SYSTEM Patent
John F. Garren, Jr. and James R. Kelley, inventors (to NASA) Issued 20 Oct. 1970 (Filed 24 Feb. 1969) 5 p Cl. 244-76; Int. Cl. B64c13/18
(NASA-Case-XLA-06339; US-Patent-3,534,930;
US-Patent-Appl-SN-801336) Avail: US Patent Office CSCL 01B

A mechanical stabilization system for VTOL aircraft is described. The system includes methanical means for modifying a pilot's control signal to obtain a desired rate signal. The desired rate signal is compared with the actual rate signal and an error signal is generated. The error signal is then compared with a modified lead signal and used to control a surface actuator. The system has a high level of damping for external disturbances and a low level of damping for pilot maneuver control signals. N.E.N.

N71-14430*# American Airlines, Inc., New York.
AIR TRANSPORTATION
Richard F. Lambert *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 39–53 (See N71-14426 04-34) Avail: NTIS

Control problems in airline operations are identified, with emphasis on airfreight handling, and examples of solutions to these problems are mentioned. Problem areas covered include: navigation systems, airport construction, smoke and noise reduction, jumbo size jet passenger traffic and cargo handling, and applications of computers in maintenance operations. E.C.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-13423# TRW Systems, Redondo Beach, Calif.
TRANSIT RTG, PROGRAM REPORT NO.1
15 Jan. 1970 233 p refs

(Contract AT(29-2)-2617)
(ALO-2617-1; TRW-11484-6010-T0-00) Avail: NTIS

The selected radioisotope thermoelectric generator (RTG) conversion system configuration and support equipment are described. Results of other research are summarized on the RTG heat source, thermoelectric converter, heat source support structure, nuclear safety engineering, and support equipment. NSA

N71-13424*# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT OF UNIFORM AND PREDICTABLE BATTERY MATERIALS FOR NICKEL-CADMIUM AEROSPACE C CELLS Quarterly Report, 8 Dec. 1967 –7 Mar. 1970
7 Mar. 1970 35 p refs
(Contract NAS5-11561)
(NASA-CR-115790; QR-6) Avail: NTIS CSCL 10C

A program to assess the different methods of impregnation of nickel cadmium battery plates is reported. It is pointed out that weight gain alone is insufficient characterization because of the ill-defined stoichiometry of the active materials (incomplete utilization at the negative and nonintegral stoichiometry at the positive). Analytical methods are therefore required to define distribution and utilization. The techniques are described that were established to meet those requirements. For the negative plates, both the charged and discharged forms of the active material were readily determined since the ionic form dissolves readily in ammoniacal NH4Cl where cadmium metal is unaffected. After separation, the two forms of cadmium were determined by EDTA titration. A similar approach to the analysis of the positive electrode resulted in significant errors due to corrosion of the nickel substrate. A novel approach involving potentiostatic control of the plate during the extraction process successfully eliminated the corrosion problem, but its application is limited to analysis of the plate in the discharged state. For this reason and because both the charged and discharged species are soluble in any extraction solution, a separate determination of the state of charge is necessary. Author

N71-13425*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Dept.
REMOTE ACTIVATED SILVER-ZINC BATTERY PERFORMANCE Interim Report
Bill Van Tine 2 Nov. 1970 72 p Prepared for JPL
(Contract NAS7-100)
(NASA-CR-115786; QE/C-70-807) Avail: NTIS CSCL 10C

The results are presented of a test program to determine: (1) the effects of wet-stand time after activation on battery performance; (2) the effect of storage temperature and time on battery performance prior to activation; and (3) the capability of the battery to be recharged and cycled. Author

N71-13426*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS. EVALUATION OF STORAGE METHODS, OPEN CIRCUIT VERSUS CONTINUOUS TRICKLE CHARGE, SONOTONE 3.5 AMPERE-HOUR SEALED NICKEL-CADMIUM SECONDARY SPACECRAFT CELLS
R. E. Thomas 5 Nov. 1969 35 p
(NASA Order W-12397)
(NASA-CR-115787; QE/C-70-88) Avail: NTIS CSCL 10B

A 5-year test program was conducted to compare, after each successive 1-year storage period, the discharge and charge characteristics of charged cells on open circuit versus that of cells on continuous trickle charge. The results of the first four years of testing are presented and indicate the following: (1) The initial capacities of charged cells following the first, second, third, and fourth 1-year open circuit periods are unreliable. (2) The initial capacitities of charged cells following the first, second, third, and fourth 1-year trickle charge storage periods are reliable. (3) Conversely, the second and third discharge capacities of cells following successive yearly open circuit storage periods are reliable, and averaged considerably higher than the capacities of cells following the first 2 years of trickle charge storage. (4) The open circuit recovery voltages for cells on the fourth 1-year open circuit storage period were zero for each of the remaining cells. D.L.G.

N71-13427*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
PARAMETRIC STUDY OF THE PERFORMANCE CHARACTERISTICS AND WEIGHT VARIATIONS OF LARGE-AREA ROLL-UP SOLAR ARRAYS
J. V. Coyner, Jr. and R. G. Ross, Jr. 15 Dec. 1970 31 p refs
(Contract NAS7-100)
(NASA-CR-115821; JPL-TR-32-1502) Avail: NTIS CSCL 10B

An analysis has been conducted to determine the relationships between the performance characteristics (power-to-weight ratio, blanket tension, structural member section dimensions, and resonant frequencies) of large-area roll-up solar arrays of the single-boom, tensioned-substrate design. The study includes the determination of the size and weight of the base structure supporting the boom and blanket and the determination of the optimum width, blanket tension, and deployable boom stiffness needed to achieve the minimum-weight design for a specified frequency for the first mode of vibration. A computer program has been used to generate a set of plots that provide optimum structural sizing and estimated weights for arrays with blanket areas ranging from 100 to 400 square feet and for first-mode natural frequencies ranging from 0.03 to 0.7 Hz. Use of these plots enables a quick evaluation of the potential merits of a proposed roll-up array. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-13428*# Naval Aerospace Medical Inst., Pensacola, Fla. Research Lab.
NUCLEAR EMULSION RECORDINGS OF THE ASTRONAUTS' RADIATION EXPOSURE ON THE FIRST LUNAR LANDING MISSION APOLLO 11
Hermann J. Schaefer and Jeremiah J. Sullivan 29 Jun. 1970 30 p refs Sponsored by NASA
(NASA-CR-115804; AD-711316; NAMRL-1112) Avail: NTIS CSCL 06R

Ilford G.5 and K.2 emulsions in radiation packs carried by the astronauts on Apollo XI in their space suits were analyzed for identifying the various components of the radiation field in space and determining the total mission dose. In terms of dose equivalents, trapped protons in the radiation belt, disintegration stars in tissue, galactic heavy primaries, electrons, and neutrons contribute in that order to a total mission dose of 201 millirad or 402 millirem. In this exposure, the high-ZE particles with LET values up to 3600 kev/micron tissue constitute a radiobiologically unknown quantity since it is generally agreed upon that microbeam effects in tissue cannot be measured adequately with conventional dosimetric units. Assuming that the effects in question are limited to nuclei of Z = 22 and higher, one arrives at a total mission flux of 76 nuclei/sq. cm. measured on the body of the astronaut; this cannot be properly assessed in its biological significance. Author (TAB)

N71-13429# Weather Bureau, Salt Lake City, Utah.
EXPERIMENTAL AIR QUALITY FORECASTS IN THE SACRAMENTO VALLEY

Norman S. Benes Aug. 1970 23 p refs
(PB-194128; ESSA-TM-WBTM-WR-53) Avail: NTIS CSCL 13B

About 400,000 acres of rice are harvested annually in the Sacramento Valley. The disposal of straw and rubble residue after harvest presents a problem of large proportions to the rice grower. Historically, burning of this straw has been the most efficient means of disposal. With steady urban encroachment into the agriculturally productive areas of California, a tolerance limit is fast approaching regarding acceptable air quality standards. Individual counties within the air basins retained the right to establish their own air pollution control district. Author (USGRDR)

N71-13430# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.

TWO-FLASH THRESHOLDS AS A FUNCTION OF COMPARISON STIMULUS DURATION

Sep. 1970 6 p refs
(FAA-AM-70-15) Avail: NTIS

The proposal that two-flash thresholds may be used as direct measures of the critical duration of Bloch's law was tested. Two-flash threshold was found to be an increasing function of comparison stimulus duration for durations of 3 to 22 msec indicating that two-flash threshold does not measure the critical duration. Increasing luminance in the range of 1.0 to 3.0 log mL enhanced the effect. Application of these data to specifications for strobe lights used as anticollision devices is discussed. Author

N71-13431# Joint Publications Research Service, Washington, D.C.

HELIOGEOPHYSICAL FACTORS IN INFECTIONS

Z. P. Konovalenko et al 16 Nov. 1970 17 p refs Transl. into ENGLISH from Izv. Vses. Geogr. Obshchestva (USSR), no. 4, 1970 p 347–355
(JPRS-51788) Avail: NTIS

The periodicity of epidemics was investigated and compared to that of sunspots. Epidemics of malaria, whooping cough, diphtheria, and scarlet fever were studied using data from the 1880's from Europe, Japan, and the United States. It is concluded that epidemic cyclicity is dominated by periods of 3, 5, 8, 11, 14, and 18-19 years. It is felt that part of these cycles is related to special features of solar activity, and particularly to its abrupt changes. It is suggested that the influence of solar activity may be direct or through climatohydrological conditions. It may be achieved through changes in the reactivity of the human organism, the biological properties of the microorganism, and channels of infection transmission. N.E.N.

N71-13432# National Defense Research Organization TNO, The Hague (Netherlands). Chemistry Lab.

A SIMPLIFIED SLIDE RULE FOR THE DETERMINATION OF DOWNWIND SAFETY LIMITS FOR TOXIC VAPOURS [EEN VEREENVOUDIGDE REKENSCHIJF VOOR HET BEPALEN VAN BENEDENWINDSE DAMPVEILIGHEIDS-GRENZEN]

C. J. P. van Buijtenen May 1970 25 p refs In DUTCH; ENGLISH summary
(Rept-1970-13) Avail: NTIS

A description is given of how a simplified version was constructed of a previously constructed slide rule for the determination of the safety limits downwind from an instantaneous source of toxic vapor. The simplification could be realised without significant loss of accuracy by using stability classes instead of continuously variable stability parameters and by using a different way of introducing the sourcelength correction factor. Author

N71-13433# Flying Personnel Research Committee, London (England).

A BRIEF DESCRIPTION OF FIVE PUBLISHED PAPERS RELATING TO WORK PARTIALLY SUPPORTED BY A MINISTRY OF DEFENCE (AIR) EXTRA-MURAL RESEARCH GRANT ON THE USE OF LOWER BODY SUCTION AND SIMILAR TECHNIQUES IN THE STUDY OF CARDIOVASCULAR REACTIONS TO FLIGHT

Feb. 1970 3 p refs
(FPRC/1298) Avail: NTIS

Summaries are presented of papers on subatmospheric pressure effects on blood vessels of the forearm, treatment of idiopathic orthostatic hypotension, electromagnetic pressure generator for testing pressure transducers and catheter systems, and dome design for pressure transducer. N.E.N.

N71-13855# Argonne Universities Association, Ill.

UNIVERSITIES, NATIONAL LABORATORIES, AND MAN'S ENVIRONMENT CONFERENCE

Nov. 1969 167 p Conf. held at Chicago, 27-29 Jul. 1969 Sponsored by AEC
(CONF-690705) Avail: NTIS

The proceedings of a conference on the role of the national laboratories and universities in the solution of environmental problems are presented. Papers were presented on social problems and the interaction of problem solving agencies; standards for, and the control of, environmental quality; waste disposal practices; radiation protection standards; research requirements; and automobiles and air pollution. NSA

N71-13866# Technische Hochschule Darmstadt (West Germany). Fakultaet fuer Maschinenbau.

ELECTROMYOGRAPHY AS SCIENTIFIC RESEARCH METHOD FOR EVALUATING STATIC MUSCLE WORK [ELEKTROMYOGRAPHIE ALS ARBEITSWISSENSCHAFTLICHE UNTERSUCHUNGSMETHODE ZUR BEURTEILUNG VON STATISCHER MUSKELARBEIT]

Wolfgang Laurig (Ph.D. Thesis) 1970 107 p refs In GERMAN
Avail: NTIS

The classical stretch reflex model is used to develop functional mathematical models for muscle control during static work and for an antagonistical muscle group. A qualitative description of the control behavior for the stabilization of the optimal reaction power of static muscle work is obtained. Correlative analyses establish that in this control loop the electromyogram consist of an uncontrolled signal with superimposed periodic components. Normalized defined boundary conditions are used to reproduce the scattered field of the electrical activity. Studies on variously sized muscles establish the effects of cohesion and duration on electrical activity during static muscle work. Relaxation studies show that intervals reduce the time-dependent part of the electrical activity. Comparative pulse frequency measurements confirm the close relationship between electrical activity behavior and pulse frequency during static muscle work. Transl. by G.G.

N71-13867# Pennsylvania Univ., Philadelphia. Johnson Research Foundation.

ENERGY METABOLISM AND ITS CONTROL IN HIGHER PLANTS Progress Report, Sep. 1968–Jul. 1970

Walter D. Bonner, Jr. 13 Jul. 1970 30 p refs
(Contract AT(D-1)-3729)
(TID-25485) Avail: NTIS

Efforts in a continuing program of research are reported and include: (1) investigations on the kinetics of cytochrome oxidation in mung beam hypocotyl mitochondria and in skunk cabbage spadix mitochondria; (2) studies of the metabolic events ingermanating peanut embryos during the first few hours following inbibition; (3) optical studies of castor beam glyoxysomes including spectrophotometric observations of the catalase and flavoproteins contained in these organelles as well as fluorescence observations on both pyridine nucleotide and flavoproteins; and (4) investigations of phosphorylation sites in the plant mitochondrial respiratory chain. D.L.G.

N71-13868*# National Aeronautics and Space Administration, Washington, D.C.
POLYCYTHEMIA IN SUBJECTS ENGAGED IN UNDERWATER ACTIVITY [POLYGLOBULIA IN SOGGETTI ESERCITANTI ATTIVITA SUBACQUEA]
P. Sannazzari et al Dec. 1970 5 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Italy), v. 45, no. 7, 1969 p 399-401
(NASA-TT-F-13422) Avail: NTIS CSCL 06P

The results of polycythemia examinations conducted in 140 professional underwater workers are reported. It is concluded that polycythemia and a fall in hemoglobin result from an imperfect blending of respiratory and alveolar air, which is due to pressure and temperature conditions unique to underwater work. Author

N71-13876# Advisory Group for Aerospace Research and Development, Paris (France).
EDUCATION AND TRAINING IN AEROSPACE MEDICINE, 1970
D. I. Fryer, ed. Nov. 1970 135 p refs Presented at AGARD Aerospace Med. Panel Specialist Meeting, Oslo, 12-13 May 1970 (AGARD-CP-75-70) Avail: NTIS

Papers are presented on civil and military aerodmedical practitioners, short-service medical officers, medical auxiliaries, flight nurses and aircrews, and survival training. For individual titles see, N71-13877 through N71-13897.

N71-13877# Canadian Armed Forces of Environmental Medicine, Toronto (Ontario). School of Aviation Medicine.
AEROMEDICAL TRAINING IN THE CANADIAN FORCES
C. A. Burden *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 9 p (See N71-13876 04-04)
Avail: NTIS

The current aeromedical training programs in the Canadian Forces are presented. The activities of the School of Aviation Medicine in training aviation medical personnel is discussed. Also presented is the organization and activities of the aeromedical training units in the field in order to illustrate the continuing education and training of aircrew and jet passengers. Operational aeromedical support is mentioned as a part of the field aeromedical unit function. In describing the School of Aviation Medicine, the paper gives a resume of the courses given to flight surgeons, bioscience officers, bioscience technicians, flight safety officers, aircrew and jet passengers. Additional training available to flight surgeons and bioscience officers is included, as is School of Aviation Medicine assistance in the aeromedical education of civilian aircrew. Author

N71-13878# School of Aerospace Medicine, Brooks AFB, Tex.
EDUCATION OF THE UNITED STATES AIR FORCE FLIGHT SURGEON
Samuel J. Brewer *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 7 p (See N71-13876 04-04)
Avail: NTIS

The Aerospace Medicine Program of the United States Air Force functions to promote and maintain the physical and mental health of Air Force personnel. Surgeons are required at all levels of command to manage and participate in this program. The content and method of teaching various courses at the United States Air Force School of Aerospace Medicine to provide trained physicians for these requirements are presented. Author

N71-13879# Army Aviation School, Fort Rucker, Ala. Dept. of Aeromedical Education and Training.
AVIATION MEDICINE TRAINING PROGRAMS IN THE US ARMY
William G. Caput *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 7 p (See N71-13876 04-04)
Avail: NTIS

The aviation medicine training programs of the U.S. Army are discussed. Subjects presented are: (1) basic Army flight surgeon training, (2) intermediate and specialized Army aviation training programs, (3) advanced Army aviation medicine training program, and (4) physiological training program for flying personnel. Author

N71-13880# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
AVIATION MEDICINE TRAINING IN THE ROYAL AIR FORCE
H. L. Roxburgh *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 4 p (See N71-13876 04-04)
Avail: NTIS

The historical development of training in aviation medicine in the Royal Air Force is briefly described. The present situation is outlined and possible weaknesses indicated along with suggestions for improvement. Author

N71-13881# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
AEROMEDICAL TRAINING IN THE ROYAL AIR FORCE: THE ROLE OF TRAINING SECTION AT THE ROYAL AIR FORCE INSTITUTE OF AVIATION MEDICINE
A. T. Johnson and E. D. J. Diaper *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 7 p (See N71-13876 04-04)
Avail: NTIS

The functions of the Training Section of the Royal Air Force Institute of Aviation Medicine are discussed. Subjects presented are: (1) responsibilities of the training section, (2) nature of the training programs conducted, and (3) personnel and textbooks used for the courses. Author

N71-13882# Centre d'Enseignement et de Recherches de Medecine Aeronautique, Paris (France).
CURRENT AEROMEDICAL EDUCATION IN FRANCE
A. R. Missenard *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)
Avail: NTIS

Aerospace medicine training programs in France are discussed. Subjects presented are: (1) basic training in aviation medicine, (2) specialized training in aviation medicine, and (3) training of paramedical personnel. Author

N71-13883# Flugmedizinisches Institut der Luftwaffe, Fuerstenfeldbruck (West Germany).
AEROMEDICAL TRAINING PROGRAM FOR MEDICAL AND PARAMEDICAL PERSONNEL IN THE GERMAN ARMED FORCES
A. J. Gerbe *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)
Avail: NTIS

The types, duration, and curricula of training courses held at the Institute of Aviation Medicine of the German Air Force are discussed. Subjects presented are: (1) primary course in aviation medicine, (2) indoctrination of medical officers in aviation and industrial medicine, (3) aeromedical training for dentists, (4) aeromedical technician course, and (5) training of air evacuation personnel. Author

N71-13884# Royal Norwegian Air Force, Oslo.
EDUCATION AND TRAINING IN AEROSPACE MEDICINE IN THE ROYAL NORWEGIAN AIR FORCE
Vogt Lorentzen *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 4 p (See N71-13876 04-04)
Avail: NTIS

Aerospace medical training the the Norwegian Air Force is duscussed. Subjects presented are: (1) medical officer training, (2) flight nurse training, (3) paramedical personnel training, and (4) aircrew training. Author

N71-13885# Italian Air Force Military School of Aviation Medicine, Rome.

TEACHING OF AEROSPACE MEDICINE IN THE MILITARY AND CIVIL FIELD IN ITALY

Aristide Scano *In* ATARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)

Avail: NTIS

Aerospace AGARD training for Italian military and civilian flying personnel is discussed. Subjects presented are: (1) courses for medical officers, (2) courses for sanitary personnel, and (3) aerophysiological training for flight crews. Author

N71-13886# Flugmedizinisches Institutt der Luftwaffe, Fuerstenfeldbruck (West Germany).

CIVIL AEROSPACE MEDICAL ACTIVITIES IN GERMANY

Erwin A. Lauschner *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 5 p (See N71-13876 04-04)

Avail: NTIS

An increasing number of medical and technical faculties are including aeromedical subjects and lectures in their teaching programs. The main civilian aerospace medical activities are concentrated in the Institute of Aviation Medicine of the German Air Force and its civilian counterpart, the German Aerospace Medicine Association. A large part of the postgraduate training program for medical doctors is provided by these institutions. Lufthansa has finally its own aeromedical service. The situation in the German aircraft industry is still deficient but improving. Author

N71-13887# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

THE DIPLOMA IN AVIATION MEDICINE OF THE ROYAL COLLEGE OF SURGEONS (ENGLAND) AND ROYAL COLLEGE OF PHYSICIANS (LONDON)

D. I. Fryer *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 7 p (See N71-13876 04-04)

Avail: NTIS

The basic requirements of training required for candidates taking the examination of the Diploma in Aviation Medicine of the Conjoint Board are described. The format of the course of instruction at Farnborough is considered and problems are outlined. Author

N71-13888# Air Corporations Joint Medical Service (BEA/BOAC), London (England).

TRAINING OF FLIGHT SURGEONS FOR CIVIL AIRLINES

F. S. Preston *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)

Avail: NTIS

The history of the U.K. civil airlines and their medical departments subsequent to World War II are described. The vast majority of flight surgeons employed between 1946 and 1964 had previous medical training in the armed services. With the contraction of the latter in the sixties, it was necessary to look for recruits from elsewhere. The setting up of the U.K. Diploma of Aviation Medicine has allowed considerable input from the regulatory and airline medical departments which has ensured that diplomates are civil as well as militarily orientated. Future flight surgeons will be required to be in possession of this diploma before employment. The development of the Diploma Course to full Faculty status is a logical development as far as the United Kingdom is concerned. There is a great need in this country to ensure the steady flow of suitably qualified doctors into the civil and regulatory medical departments as the aviation industry expands. Author

N71-13891# Royal Netherlands Air Force, Soesterberg. Aeromedical and Industrial Medicine Section.

EDUCATION AND TRAINING IN AEROSPACE MEDICINE IN THE ROYAL NETHERLANDS AIR FORCE

F. A. F. Cartens *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 5 p (See N71-13876 04-04)

Avail: NTIS

The physiological training in the Royal Netherlands Air Force started in 1952 under the supervision of the Surgeon General, Royal Netherlands Air Force. In 1957 the specific training on sea and land survival intensified and resulted in the foundation of the Flight Safety Training and Test Center (FSTTC). The physiological training is given as an integral part of the FSTTC. Every crew member will undergo this training every 18 months. Different courses in aeromedical education are covered and available facilities shown. Author

N71-13896# Ecole d'Application de Medecine Aeronautique, Paris (France).

SPECIAL ASPECTS OF THE TEACHING OF RADIOLOGY AND RADIOBIOLOGY IN AVIATION MEDICINE

R. P. Delahaye *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)

Avail: NTIS

Radiology plays an effective role in many areas of aviation medicine: detection of diseases and selection of candidates, flying personnel fitness control, research, aircraft accident investigations, man's adaptation to equipment. The teaching of radiology in aviation medicine proves indispensable to acquaint students with some specific aspects of relevant diseases, as well as with the value and limitations of the methods used. At the selection stage, it is important to know the experts' attitudes and their reasons in evaluating a certain number of facts: normality, the characteristics of which evolve with time, selection criteria in terms of lesions observed and experts' prvsious positions. When studying diseases relevant to aviation students should be given a detailed description of the radiological aspects of the main diseases commonly encountered: fracture of the spine, digestive and excretory. Author

N71-13897# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

TABULATION OF RESULTS OF FLIGHT SURGEON TRAINING QUESTIONNAIRE

D. I. Fryer *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 3 p (See N71-13876 04-04)

Avail: NTIS

The education, experience, and qualifications of flight surgeons and medical personnel of various countries is presented. Variety of courses, main training subjects, course schedules, duration, and number of students are discussed. A summary of the subjects discussed during the conference on aerospace medicine is provided. Author

N71-13898*# National Academy of Sciences-National Research Council, Washington, D.C. Space Science Board.

SPACE BIOLOGY

1970 61 p refs

(Contract NSR-09-012-075)

(NASA-CR-115803) Avail: NTIS CSCL 06B

Biological investigations in the space environment were considered in the context of the general advancement of biology as a whole. Recommended subjects for research are: (1) circadian rhythms, (2) cells, plants and invertebrates in space, (3) man and vertebrates in space, (4) radiobiology, and (5) animal orientation and tracking. F.O.S.

N71-13899# Hittman Associates, Inc., Columbia, Md.

DEVELOPMENT OF IMPROVED CAPACITIVE ELECTRODES FOR ELECTROCARDIOGRAPHIC MONITORING Final Report

William M. Kaufman 25 Jul. 1970 36 p refs
(Contract PHS-69-2239)
(PB-194496; HIT-462; NIH-69-2239-1) Avail: NTIS CSCL 06B

The work culminated in the development of an operational prototype capacitive electrode which consists of a self-contained preamplifier and a thin-film coupling capacitor and which, although not designed for clinical use, could be used to obtain physiological electrocardiographic signals. The thin-film coupling capacitor is made of Mylar (TM) and can be easily replaced if it should become damaged. Previous designs involved coupling films that were integral portions of the entire electrode package, thus, when the thin coupling film became damaged, the entire electrode had to be replaced. The integral preamplifier required dc power, so a battery box was provided with each set of monitoring electrodes. A coupling filter for each electrode was included in each battery box to provide controlled shaping of the frequency response characteristics of each electrode. Author (USGRDR)

N71-14463# Joint Publications Research Service, Washington, D.C.
SLEEP AND TRANSITIONAL STATES IN MAN UNDER SPACE FLIGHT CONDITIONS
10 Nov. 1970 11 p refs Transl. into ENGLISH from the Publ. 'Materialy Impoziuma po Izucheniyu Osobennostey Sna i Perekhodnykh Sostoyaniycheloveka Primenitelno K Zadacham i Usloviyam Kosmicheskogo Poleta (22-24 January 1968)' Moscow, Izd. An SSSR, 1968 p 40-46 and 89-91
(JPRS-51763) Avail: NTIS

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1. SIGNIFICANCE OF SLEEP IN THE EVALUATION OF MAN'S INDIVIDUAL PSYCHOLOGICAL CHARACTERISTICS O. N. Kuznetsov et al p 1-3 refs (See N71-14464 04-04)

2. SLEEP AS INDICATOR OF MAN'S ABILITY TO ADAPT TO CONDITIONS OF PROLONGED SOLITARY ISOLATION WITH ALTERED DAY-NIGHT REGIMES O. N. Kuzetson et al p 4-7 refs (See N71-14465 04-04)

3. THE POSSIBILITY OF APPLYING AUTOGENOUS TRAINING FOR THE PSYCHOLOGICAL PREPARATION OF MAN FOR SPACE FLIGHTS A. M. Svyadoshch et al p 8-10 refs (See N71-14466 04-05)

N71-14464# Joint Publications Research Service, Washington, D.C.
SIGNIFICANCE OF SLEEP IN THE EVALUATION OF MAN'S INDIVIDUAL PSYCHOLOGICAL CHARACTERISTICS
O. N. Kuznetsov et al *In its* Sleep and Transitional States in Man Under Space Flight Conditions 10 Nov. 1970 p 1-3 (See N71-14463 04-04)
Avail: NTIS

Sleep characteristics effecting human performance on aircraft, submarines, and spacecraft are examined. Test results of astronauts kept in soundproof chambers over a prolonged period of time are discussed. Differential criteria for sleep are also presented, including (1) length, ritual, stereotypy, and certainty of falling asleep; (2) the ability to fall asleep at various hours of day or night; (3) the ability to vary time of nocturnal falling asleep; (4) the requirement for sleep during periods of habitual wakefulness; and (5) duration and depth of sleep. J.A.M.

N71-14465# Joint Publications Research Service, Washington, D.C.
SLEEP AS INDICATOR OF MAN'S ABILITY TO ADAPT TO CONDITIONS OF PROLONGED SOLITARY ISOLATION WITH ALTERED DAY-NIGHT REGIMES
O. N. Kuzetsov et al *In its* Sleep and Transitional States in Man Under Space Flight conditions 10 Nov. 1970 p 4-7 refs (See N71-14463 04-04)
Avail: NTIS

Man's neuropsychic stability was studied using a soundproof chamber with an altered day-night regime. The main parameters of the external medium affecting sleep were: isolation, duration of required sleep, shifting of hours of sleep in relation to the usual time, determined interruption of sleep, and relative discomfort. A complex investigation of sleep varieties with different daily regimes, simultaneous with an efficiency study, permitted making an analysis of the subjective difficulties in adaptation to shifted and intermittent regimes. J.A.M.

N71-14468*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
DETECTION OF SEVERAL NON-PROTEIN AMINO ACIDS IN THE PRESENCE OF PROTEIN AMINO ACIDS
Paul Shepshak [1970] 11 p refs Submitted for publication
(Grant NGR-33-010-101)
(NASA-CR-115805; CRSR-408) Avail: NTIS CSCL 06A

Evidence is presented that the following nonprotein amino acids are detectable and simultaneously distinguishable from protein amino acids: alpha-amino butyric acid, beta-alanine, taurine, nor-valine, sarcosine, nor-leucine, homocystine, betaine, hydroxy-proline, and L, L-alpha, epsilon diamino-pimelic acid. Urea was also run. Data for cis-delta to the 4th power-dehydro-lysine, and 3,5-diamino-hexanoic acid which appear close to lysine in the amino analysis chromatogram are also given. The Beckman Model 120 Amino Acid Analyzer was used in these studies. Author

N71-14469# RAND Corp., Santa Monica, Calif.
INDUCED FIELDS AND HEATING WITHIN A CRANIAL STRUCTURE IRRADIATED BY AN ELECTROMAGNETIC PLANE WAVE
A. R. Shapiro, R. F. Lutomirski, and H. T. Yura Sep. 1970 33 p refs
(AD-712845; P-4458) Avail: NTIS CSCL 6/18

The induced fields and the static heating patterns within a multi-layered spherical model that approximates the primate cranial structure irradiated by plane waves in the microwave spectrum are calculated. The relation of the model to the biological structure and the sensitivity of the results to the uncertainties in the dimensions and electrical properties of biological material are investigated. A method of solution for both the scattered and interior fields for a sphere with an arbitrary number of electrically different concentric layers is developed in a form readily amenable to machine computation. It is shown that the semi-infinite slab model is inappropriate for calculating the microwave radiation dosage to the human head and similar structures. Author (TAB)

N71-14470# Atomic Energy Commission, New York. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Sep.-1 Dec. 1969
Edward P. Hardy, Jr. and Joseph Rivera 1 Jan. 1970 410 p refs
(HASL-217) Avail: NTIS

Data are presented from the HASL Fallout Program, The National Radiation Laboratory in New Zealand, the EURATOM Joint Nuclear Research Centre at Ispra, Italy, and the Radiological Physics Division at Argonne National Laboratory. Interpretive reports and notes cover the following topics: strontium-90 levels in 1968 Czechoslovakian human bone, cesium-137 concentrations at moderate depths in the Pacific (1965 to 1968), land run-off and ocean fallout radioactivity, quality control analyses at HASL, and induced radionuclides from recent French and Chinese thermonuclear tests. Subsequent sections include tabulations of radionuclide levels in stratospheric air by balloon-borne and aircraft samplers, surface air, fallout, milk, other diet components, and tap water. A bibliography of recent publications related to radionuclide studies is also presented. Author

N71-14471*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Nov. 1970 127 p refs
(NASA-SP-7011) Avail: NTIS CSCL 06B

Aerospace Medicine and Biology is a continuing bibliography which, by means of periodic supplements, serves as a current abstracting and announcement medium for references on this subject. The publication is compiled through the cooperative effort of the American Institute of Aeronautics and Astronautics (AIAA) and NASA Scientific and Technical Information Facility. It assembles, within the covers of a single bibliographic announcement, groups of references that were formerly announced in separate journals, and provides a convenient compilation for medical and biological scientists. Supplements are identified by the same number followed by two additional digits in parentheses. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Author

N71-14472# National Air Pollution Control Administration, Raleigh, N.C.
NITROGEN OXIDES: AN ANNOTATED BIBLIOGRAPHY
Aug. 1970 636 p refs
(PB-194429; NAPCA-Pub-AP-72) Avail: SOD $2.75; NTIS CSCL 13B

Approximately 1500 abstracts of technical literature related to nitrogen oxides and air pollution are presented. The abstracted literature was collected from many sources; all are now included in the information retrieval system of the Air Pollution Technical Information Center (APTIC). Most of the literature is recent (1959–1970). The abstracts are arranged in thirteen broad subject categories. Subject, author, and geographic location indexes are included; the author index lists first and second (if any) authors individually. The geographical location index includes two sections; United States (states/cities); and foreign (countries/cities). Author (USGRDR)

N71-14473# Atomic Energy Commission, Washington, D.C.
ENVIRONMENT: A GLOBAL PROBLEM, AN INTERNATIONAL CHALLENGE
Glenn T. Seaborg 10 Aug. 1970 8 p Presented at the Environ. Aspects of Nucl. Power Sta., New York
(CONF-700810-37) Avail: NTIS

The effects of worldwide power requirements on the environment are discussed. Problems related to future power demands are analyzed. NSA

N71-14474# Eye Research Foundation of Bethesda, Md.
MEASUREMENT OF RETINAL IMAGE FOR LASER RADIATION IN RHESUS MONKEY Final Report
Marvin N. Stein and Stephen S. Elgin Feb. 1970 37 p refs
(Contract F41609-68-C-0038)
(AD-702865; Rept-7005-703f) Avail: NTIS CSCL 6/5

The techniques described were developed to corroborate the feasibility of making in vivo measurements of image parameters in the interior of the eye. The preliminary experiments on excised eyes demonstrated that the procedure for photographing the image was a reliable and valid way to record the image for detailed examination. The design of a suitable fiber optics conduit posed several difficult problems. However, it was demonstrated that the design achieved does provide a means for transmitting the information directly to an external detector and that the resolution of the system can be made sufficiently high to provide the required fidelity. The results of the in vitro experiments with excised eyes indicate that 20 micron diameter at intensity value of 1/e of maximum is probably the limiting size one can expect to find for an emetropic, light adapted rhesus monkey eye. The in vivo measurements derived from a limited number of samples resulted in values of 32 microns for a 2mm pupil and 37 microns for a 4mm pupil. Author

N71-14475# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE SCALING PROBLEM IN THE CLASSIFICATION OF IMAGES BY SPATIAL FILTERING
Richard A. Gill (M.S. Thesis) May 1970 92 p refs
(AD-712686; GA/BE-70-1) Avail: NTIS CSCL 6/4

The purpose of this investigation is to modify an existing model of the human visual system, based on the spatial filtering of the two-dimensional Fourier transform of an input stimulus, to allow for considerable scale changes in the input stimuli. The primary tool compensation, the scaling property of the Fourier transform is discussed and its application to discrete two-dimensional patterns is presented. A method for determining the scale factor of an input pattern, given some a priori information on several input patterns, is described. The scale factors derived from this method are shown to relate to the human estimation of size. A complete scaling algorithm, applicable to many pattern recognition problems, is presented. The results of two computer simulations, using this algorithm, are presented. The first simulation demonstrates the successful classification of handwritten geometric outlines, with moderate scale differences, and the second simulation shows the classification of Russian characters with scale differences of up to 3.5 to 1. These results clearly demonstrate both the need for the scaling algorithm and its effectiveness. Author (TAB)

N71-14476# Environmental Health Service, Rockville, Md.
TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME 1: MANAGEMENT ASSISTANCE AND PLANNING Final Report
David L. Morrison, D. B. Menzel, K. L. Nielson, A. A. Levin, C. W. Hamilton 29 Jun. 1970 104 p refs
(Contract PHS-CPS-69-005)
(PB-19441; CPS-69-005-1-Vol-1) Avail: NTIS CSCL 05A

The concepts embodied in the development and implementation of a comprehensive R and D and program planning capability for EHS were examined. Environmental stressors were selected as the basis for planning rather than categorical approaches. For the mix of complex problems encountered by EHS, a system to establish priorities is required. The integrated planning system which was recommended utilizes mathematical models to assess the impacts of technology upon man and his environment and the assignment of priorities based upon quality of life indices. A hierarchical approach to the development of mathematical models for prediction of the impacts of stressors upon man and the environment was described and specific examples are presented for lead in the environment. See also N71-14477, N71-14478, N71-14479, and N71-14480. Author (USGRDR)

N71-14477# Environmental Health Service, Rockville, Md.
TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME 2: EHS INFORMATION NETWORK ANALYSIS Final Report
Ralph L. Darby, Robert S. Kohn, Thomas E. Carroll, W. David Penniman, and David L. Morrison 29 Jun. 1970 147 p refs
(Contract PHS-CPS-69-005)

(PB-194411; CPS-69-005-2-Vol-2) Avail: NTIS CSCL 05B

The study for the Environmental Health Service is an investigation of the problems being faced in protecting man's environment from threats created by man. This study included the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. This volume of the report concerns itself with information network analysis. An investigation was made of the existing EHS information resources including the monitoring and surveillance activities. A survey was conducted of the documentation systems and libraries in order to determine their operational characteristics as related to an information network. See also N71-14476, N71-14478, N71-14479, and N71-14480. Author (USGRDR)

N71-14478# Environmental Health Service, Rockville, Md.
TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME 3: LEAD MODEL CASE STUDY Final Report
Garson A. Lutz, Arthur A. Levin, Sanford G. Bloom, Kaj L. Nielsen, and Jack L. Cross 29 Jun. 1970 142 p refs
(Contract PHS-CPS-69-005)
(PB-194412; CPS-69-005-3-Vol-3) Avail: NTIS CSCL 06F

The lead model case study was undertaken to serve as a working example and to evaluate the technical, intelligence, and project information system under consideration for EHS. Occurrence and use patterns for lead within the U.S. were examined. Leaded fuels are the major source of environmental lead. Pediatric plumbism, the most significant acute health problem, arises from lead used as a pigment. The economic aspects of this problem area were investigated. A mathematical model was developed to represent the environmental transport of the stressor lead from several sources with the subsequent intake of lead by man. This model can be used to assess the impact of contemplated actions on lead body burdens, to define R and D requirements, and to identify the needs and locations for monitoring and surveillance. A categorized bibliography for lead is included. See also N71-14476, N71-14477, N71-14478, and N71-14480. Author (USGRDR)

N71-14479# Environmental Health Service, Rockville, Md.
TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME 4: PESTICIDES MODEL CASE STUDY Final Report
J. K. Voss, J. W. Blaylock, M. J. Schneider, L. C. Schwendiman, and C. J. Touhill, Jr. 29 Jun. 1970 63 p refs
(Contract PHS-CPS-69-005)
(PB-194413; CPS-69-005-4-Vol-4) Avail: NTIS CSCL 06F

DDT was selected as the compound for this study due to paucity of data regarding environmental effects of other classes of pesticides. Human exposure to pesticides was examined from two major pathways: the direct pathway which deals with direct uptake from primary sources of pesticide release, and the indirect pathway which involves human exposure by translocation through air, water, or food. Reductions in accidental poisonings could be made by limiting the total toxicant contents of home packages of pesticides, and means to reduce deaths from aerial applications warrant further study of this method of application. The control of human burden of pesticides by control of food residues is only partially effective since evidence on pesticide distribution in the environment suggests that about half of the intake is from inhalation of insecticide aerosols or dust laden with insecticides. See also N71-14476, N71-14477, N71-14478, and N71-14480. Author (USGRDR)

N71-14480# Environmental Health Service, Rockville, Md.
TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME 5: DIRECTORY OF EHS INFORMATION FACILITIES WITH SELECTED SUPPLEMENTARY RESOURCES Final Report
Ralph L. Darby, Robert S. Kohn, Thomas E. Carroll, W. David Penniman, and David L. Morrison 29 Jun. 1970 70 p refs
(Contract PHS-CPS-69-005)
(PB-194414; CPS-69-005-5-Vol-5) Avail: NTIS CSCL 05A

This study is a multifaceted and intensive investigation of the problems facing the EHS in protecting man's environment from threats created by man, including the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. This directory represents an inventory of information and data resources useful to the personnel of the Environmental Health Service. It is divided into three principal categories: (1) EHS-sponsored resources, (2) non-EHS resources, and (3) monitoring and surveillance activities of both the National Air Pollution Control Administration and the Environmental Control Administration. A subject-index, an index of information facilities, and an index of the parent or sponsoring organization are provided. See also N71-14476, N71-14477, N71-14478, and N71-14479. Author (USGRDR)

N71-14481*# Technran Corp., Glen Burnie, Md.
PHYSIOPATHOLOGICAL RESPIRATORY EVALUATION IN SUBJECTS PRACTICING UNDERWATER ACTIVITY
A. M. Ravera et al Washington NASA Dec. 1970 6 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Italy), v. 45, no. 7, 1969 p 396–398
(Contract NASw-2037)
(NASA-TT-F-13424) Avail: NTIS CSCL 06S

Static and dynamic pulmonary volumetric variations observed during special breathing exercises by professional underwater workers are discussed. The conclusion reached is that underwater breathing apparatus does not cause severe damage to the diver's respiratory system. Author

N71-14482# RAND Corp., Santa Monica, Calif.
A BRIEF SURVEY OF LITERATURE RELATING TO THE INFLUENCE OF LOW INTENSITY MICROWAVES ON NERVOUS FUNCTION
R. J. MacGregor Sep. 1970 14 p refs
(AD-712694; P-4397) Avail: NTIS CSCL 6/16

A review is provided of the behavioral, neuroelectric, and morphological effects resulting from exposure to low intensity microwave radiation. TAB

N71-14483*# Technran Corp., Glen Burnie, Md.
CLINICAL EVALUATION OF RHEOGRAPHY CARRIED OUT UNDER WATER ON SUBJECTS PRACTICING UNDERWATER ACTIVITY [VALUTAZIONE CLINICA DELLA REOGRAFIA EFFETTUATA IN IMMERSIONE SU SOGGETTI ESERCITANTI ATTIVITA' SUBACQUEA]
U. Fabris et al Washington NASA Dec. 1970 6 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Italy), v. 45, no. 7, 1969 p 394–395
(Contract NASw-2037)
(NASA-TT-F-13423) Avail: NTIS CSCL 06P

Professional underwater workers from 20 to 45 years of age were subjected to a rheographic examination which was carried out with the subjects at about 10 meters depth with recording lasting about 10 minutes. The temperature varied from 21 C at the surface to 11 C on the bottom. The electrodes were placed on the forearm and index finger and linked to the apparatus at the surface by means of a cable. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-13434*# Texas Womens Univ. Research Inst., Denton.
BONE DENSITY STUDIES OF BED REST SUBJECTS AT THE PUBLIC HEALTH SERVICE HOSPITAL IN SAN FRANCISCO, BY THE TEXAS WOMENS UNIVERSITY RADIOGRAPHIC METHOD Final Report
[1970] 153 p refs
(Contract NAS9-9427)
(NASA-CR-114784) Avail: NTIS CSCL 06P

The results are presented of a program aimed at the radiographic measurement of bone density changes in subjects participating in a bed rest - phosphate study. The data obtained represent measured changes in bone density at 12 week intervals for two groups of subjects. Data summaries include: (1) the effect of exercise and phosphate on bone density of multiple sections of the phalanx 4/2, phalanx 5/2, and os calcis; (2) changes in bone density resulting from exercise and a dietary supplement on a section at the distal end of the radius, a section at the distal end of the ulna, and a section across the capitate, (3) the effect of exercise and phosphate on bone density of the distal radius and capitate; and (4) bone density changes of specified bones for respective subjects. D.L.G.

N71-13435*# Texas Womens Univ. Research Inst., Denton.
EVALUTION OF FLIGHT FOODS UNDER HYPOKINETIC CONDITIONS, PART 1, CHAPTERS 1, 2, AND 3 Final Report
[1970] 195 p refs
(Contract NAS9-9755)
(NASA-CR-114780) Avail: NTIS CSCL 06H

An investigation is reported involving eight men who participated in a bed rest study which included a 16 day pre-bed rest equilibration period, a 56 day bed rest period, and a 2 week post-bed rest reconditioning period. The purpose of the investigation was: (1) to assess the nutritional value and the acceptability of currently available flight foods when fed for periods of time equivalent to AAP missions 3A and 3/4 under metabolic conditions similar to those which will pertain during these long exposures to null gravity; and (2) to obtain baseline data which will enhance the capability of interpreting the results of the AAP experiment on nutrition and musculoskeletal function. Methodology involved in the investigation is described and the data obtained are tabulated. Author

N71-13436*# Texas Womens Univ. Research Inst., Denton.
EVALUATION OF FLIGHT FOODS UNDER HYPOKINETIC CONDITIONS, PART 2, CHAPTERS 4 AND 5
C. M. Winget, S. E. Cronin, N. W. Hetherington, and L. S. Rosenblatt [1970] 126 p refs
(Contract NAS9-9755)
(NASA-CR-114781) Avail: NTIS CSCL 06H

The results are reported of a study to assess the effect of simulated null gravity for 56 days on the daily wave forms of body temperature and heart rate in normal human subjects. A second objective of the study was to ascertain methods for best describing in quantitative terms the observed changes in these physiological parameters. A discussion of the methodology employed is given and the data obtained are tabulated. Author

N71-13437*# Texas Womens Univ. Research Inst., Denton.
EVALUATION OF FLIGHT FOODS UNDER HYPOKINETIC CONDITIONS, PART 3, CHAPTERS 6 AND 7
[1970] 180 p refs
(Contract NAS9-9755)
(NASA-CR-114782) Avail: NTIS CSCL 06H

The results are reported of an investigation of urinary 17-hydroxycorticosteroids during a 56 day bed rest period. The material presented, however, encompasses these results and those of a previous study on the metabolism, including periodicity, of 17-ketosteroids. Both studies are described and data summaries are included. D.L.G.

N71-13438# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF SCUBA CYLINDER CORROSION, PHASE 1 Final Report, Mar.–Aug. 1970
N. C. Henderson, W. E. Berry, R. J. Eiber, and D. W. Frink Sep. 1970 116 p refs
(Contract N00014-69-C-0352)
(AD-712815) Avail: NTIS CSCL 13/4

A program was conducted to determine the cause of the corrosion that was discovered in a number of aluminum scuba cylinders, and to determine whether the rupture strength of the cylinders had been degraded by the corrosion. An examination was made of 68 corroded cylinders received from Naval facilities. Rupture experiments were conducted on new cylinders and on the most severely corroded cylinders. Detailed analyses were made of corrosion products from selected aluminum cylinders, and of corroded and uncorroded material from the ruptured cylinders. It was concluded that the corrosion in the cylinders examined had not significantly reduced the rupture strength of the cylinders. Recommendations were formulated concerning changes in manufacturing specifications, cleaning procedures, and inspection procedures to provide increased assurance that corrosion will not progress to the point of significantly degrading the rupture strength of aluminum scuba cylinders. Author (TAB)

N71-13889# Canadian Armed Forces of Environmental Medicine, Toronto (Ontario).
OBJECTIVITY IN AIRCREW OPERATIONAL AEROMEDICAL TRAINING
I. H. Anderson *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 8 p refs (See N71-13876 04-04)
Avail: NTIS

The necessity of effective aeromedical training of operational aircrew is evident from accident and incident records and statistics. Examples pertaining to the Canadian Armed Forces are quoted. The requisites of effective aeromedical training, namely knowledge of the mission, adequate training aids, the best use of available instructors, a versatile teaching rationale that can be modified as mission experience dictates, are discussed and illustrated. Followup training, the use of the practice mission and simulator missions as a training tool, and the various types of briefings that can be given are described and illustrated. Author

N71-13890# Flugmedizinisches Institut der Luftwaffe, Feurstenfeldbruck (West Germany).
PHYSIOLOGICAL TRAINING OF PILOTS AND AIRCREW IN THE GERMAN ARMED FORCES
E. Buchard *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)
Avail: NTIS

The application of modern and highly sophisticated airborne weapons within the German Air Force as well as in the German Army and Navy requires a respective education and training of the flying personnel in Physiology of Flight. Because of the geographic situation of the Federal Republic of Germany this training from the beginning was centrally planned and set up; in consequence all training in physiology of flight of all pilots and aircrew of the German Armed Forces is done at the Institute of Aviation Medicine of the German Air Force located at Furstenfeld-bruck near Munich, where the basic training as well as advanced training is performed.

The Physiological Training includes a profound theoretical indoctrination into the various topics as well as the application of numerous utensils for the practical training in demonstrations and exercises. Author

N71-13892# Royal Netherlands Air Force, Soesterberg. Aeromedical and Industrial Medicine Section.
SURVIVAL TRAINING IN THE ROYAL NETHERLANDS AIR FORCE
Th. Verheij *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)
Avail: NTIS

Survival training for flying personnel of the Royal Netherlands Air Force is discussed. The objectives of the training course are: (1) instruction, demonstration, and exercise in the physiological problems of high performance flying, and (2) instruction, demonstration, and exercise in the correct use and handling of safety equipment. Author

N71-13893# Centre d-Essais en Vol, Bretigny-sur-Orge (France). Lab. de Medicine Aerospatiale.
PHYSIOLOGICAL TRAINING OF AIRCREWS AND COOPERATION WITH ENGINEERS IN AEROSPACE MEDICAL PROBLEMS IN FRANCE
J. Colin *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 6 p (See N71-13876 04-04)
Avail: NTIS

The physiological training of military and civilian aircrews in France is discussed. Emphasis is placed on the cooperation with engineers on medical problems with a view to workload amelioration and improvement in flight safety. Author

N71-13894# Royal Air Force Aeromedical Training Centre, North Luffenham (England).
RESULTS OF POSITIVE PRESSURE BREATHING TRAINING AS SHOWN BY PERFORMANCE FOLLOWING RAPID DECOMPRESSION
R. B. Maclaren and B. H. Rance *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 10 p refs (See N71-13876 04-04)
Avail: NTIS

One method of providing for the survival of aircrew on exposure to low environmental pressures above 50,000 feet is to use positive pressure breathing techniques with body counter pressure applied through partial pressure clothing. The aims of aircrew indoctrination in positive pressure breathing are as follows: (1) to enable aircrew to recognise and identify the problems, (2) to train them to carry out the necessary procedures, and to minimize the problems, (3) to assist them to withstand the stresses produced by the problems and to safeguard them in their training programme. Some of the difficulties of positive pressure breathing training and the methods used to overcome them are described. The results of such training as measured by aircrew performance on rapid decompression in a decompression chamber are discussed and related to these problems and training methods. Author

N71-13895# School of Aerospace Medicine, Brooks AFB, Tex. Physiological Education Branch.
DEVELOPMENT OF PNEUMATIC EJECTION SEAT TRAINERS
Jared M. Dunn *In* AGARD Educ. and Training in Aerospace Med., 1970 Nov. 1970 7 p (See N71-13876 04-04)
Avail: NTIS

The USAF School of Aerospace Medicine has developed a compressed air catapult to be used in connection with Air Force ejection seat trainers. This device insures a safe and economically operated system that can duplicate simulated peak accelerations and rate of onset produced by the cartridge-powered catapult currently used in the USAF physiological training program. An emergency egress sequence trainer has been designed and developed to include all phases of escape from aircraft, such as ejection, seat separation, opening shock, and parachute landing. This device utilizes a pneumatic-powered ejection seat system which will allow a subject to be fired to a predetermined height where seat separation takes place and a brief free fall to the length of parachute risers that are attached to a carriage and cable assembly which provides a controlled descent capability. Author

N71-14429*# California Univ., Berkeley.
BIOLOGICAL CYBERNETICS
Lawrence Stark *In* NASA. Electron. Rs. Center Future Fields of Control Appl. Aug. 1969 p 23-38 (See N71-14426 04-34)
Avail: NTIS CSCL 06B

Biological control systems analysis technology is surveyed in terms of information theory; physiology, biophysics, and biochemistry; medicine; bionics or computer design and pattern recognition; and revisions in medical education programs. A bioengineering advanced graduate training course on biological control systems is outlined. E.C.

N71-14486# Joint Publication Research Service, Washington, D.C.
THE POSSIBILITY OF APPLYING AUTOGENOUS TRAINING FOR THE PSYCHOLOGICAL PREPARATION OF MAN FOR SPACE FLIGHTS
A. M. Svyadoshch et al. *In its* Sleep and Transitional States in Man Under Space Flight Conditions 10 Nov. 1970 p 8-10 refs (See N71-14483 04-04)
Avail: NTIS

Muscular relaxation is suggested for psychological preparation of men for prolonged space flights. Subjects who had never experienced hypnosis were taught through autosuggestion to slow down their heart rate from 68 to 46 beats/min or to increase it up to 144 beats/min, and to evoke a general muscular catalepsy with flexibility or cataleptic bridge and, in contrast, a state of weakened striated and smooth muscles. Experimental results of autogenous training are briefly reviewed. J.A.M.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-13439# Kansas Univ., Lawrence.
THEORY OF HYPERFINE ESR LINEWIDTH IN A LINEAR CHAIN: Cu(NH3)4SO4-H2O
Carl D. Mc Elwee 30 Jun. 1970 30 p refs
(Contract AT(11-1)-1488)
(COO-1488-19) Avail: NTIS

The specific heat and magnetic susceptibility data for Cu(NH3)4SO4-H2O (CTS) can be explained by assuming there are exchange coupled linear chains of copper ions parallel to the crystaline C axis. The dipolar contribution to the ESR linewidth in this linear chain material has been calculated to be about 10 Oe for the full width at half maximum. Exact numerical calculations of the frequency-dependent two spin correlation functions in finite Heisenberg linear chains were also made. This result, in histogram form, suggests a divergence near zero frequency. Physically, this divergence means that the exchange interaction is not modulating the electron spins as effectively as anticipated. Therefore, the exchange narrowing is not pronounced and the linewidth is broader than expected. E.M.C.

N71-13440# Electricity Council Research Center, Capenhurst (England).
ELECTROSYNTHESIS OF HYDRAZINE FROM GASEOUS AMMONIA. 1
R. Barker Mar. 1970 28 p refs
(ECRC/R264) Avail: NTIS

The chemical reactions occurring in a microwave discharge of ammonia were studied from the viewpoint of hydrazine synthesis. The yields of hydrazine, nitrogen, and hydrogen were measured as a function of gas flow-rate, pressure, power input, and gas temperature. The highest energy yield of approximately 20 gm hydrazine per kWh of energy absorbed was obtained at low power and high flow-rate, resulting in a mole concentration of hydrazine in ammonia of approximately 0.03%. Mole concentrations of hydrazine in ammonia of 0.13% were obtained at a higher power and lower flow-rate but the energy yield of hydrazine was then only approximately 4 gm/kWh. Author

N71-13441# Uppsala Univ. (Sweden). Gustaf Werner Inst.
ON THE CHEMICAL FATE OF NASCENT C 11 ATOMS INDUCED BY IRRADIATION OF WATER AND AQUEOUS SOLUTIONS WITH 185 MeV PROTONS
Tore Stenstroem (Ph.D. Thesis) Apr. 1970 198 p refs Sponsored in part by Swed. Atomic Res. Council, Swed. Cancer Soc., and Swed. Med. Res. Council
(NP-18376) Avail: AEC Depository Libraries

Results of a study of the chemical fate of C-11 atoms induced in proton-irradiated water and aqueous solutions were interpreted in terms of hot reactions leading to primary C-11 products. They were assumed to be single-carbon molecules or radicals with yields independent of solute at low concentrations, and thermal reactions, in which the primary products react in the bulk of the solution with radioinduced radicals, or in the case of C-11 radicals, with a solute to give the radioinduced oxidation of primary products yielded (C-11)O2 as the only important product at high doses. In deaerated aqueous solutions, the reactions were found to be more complicated and C-11 radicals were oxidized or reduced, or combined with organic solute radicals to give products containing more than one carbon atom. Possible applications in the field of production of organic compounds labeled with C-11 are discussed. NSA

N71-13442# Scientific Translation Service, Ann Arbor, Mich.
BEHAVIOR OF TRIVALENT ACTINIDES AND LANTHANIDE ELEMENTS IN CHLORIDE SOLUTION
Bernard Marin (Ph.D. Thesis - Paris Univ.) 1969 108 p refs Transl. into ENGLISH from French Report CEA-R-3803 Prepared for Oak Ridge Natl. Lab.
(ORNL-tr-2342; CEA-R-3803) Avail: NTIS

The complexing ability of trivalent lanthanides and actinides in chloride solutions was compared. Studies were also made on the solvation of these cations with complexing. A difference was found between Am, Cm, and rare earths (rare earths are separated into light and heavy elements). Paper electrophoresis was used for studying the complexation after a simple theory of mobilities in complex solutions was established. The hydrolysis of these cations was studied and compared in chloride solutions. Complexation with the Cl(-)ligand was studied in HCl, NH4Cl, CaCl2, CeCl3, and LiCl solutions. It was established that the complexation is the same in dilute HCl solutions but in concentrated solutions the trivalent actinides are more complexed. This difference is sharper in LiCl solutions. Different models for complexing in these solutions are proposed. Author (NSA)

N71-13443# Joint Inst. for Nuclear Research, Dubna (USSR).
SEPARATION OF TRANSURANIUM ELEMENTS WITH THE AID OF GAS CHROMATOGRAPHY OF THEIR CHLORIDES [RAZDELENIE TRANSURANOVYKH ELEMANTOV PRI POMOSHCHI GAZOVOI KHROMATOGRAFII IKH KHLORIDOV]
T. S. Zvarova et al 1970 7 p refs Transl. into ENGLISH from Russian report JINR-P6-4911 Prepared for Argonne Natl. Lab.
(ANL-Trans-843; JINR-P6-4911) Avail: NTIS

The gas chromatographic separation of protactinium, uranium, neptunium, plutonium, americium, and curium was investigated using as the gas carrier a mixture of an inert gas with aluminum chloride vapors. NSA

N71-13444# Atomics International, Canoga Park, Calif.
DEVELOPMENT OF THE MOLTEN CARBONATE PROCESS TO REMOVE LEAD AND OTHER PARTICULATES FROM SPARK IGNITION ENGINE EXHAUSTS
8 Jul. 1970 56 p refs
(Contract PHS-CPA-70-3)
(PB-194132; AI-70-47) Avail: NTIS CSCL 07A

The effectiveness of a molten alkali carbonate eutectic in removing lead compounds from gaseous mixtures was investigated. Some laboratory tests and one test of a device on an automobile were used in this investigation; results indicate that molten alkali carbonate scrubbers can be an effective method for removing lead and particulates from exhaust. The alkali metal carbonate eutectic is a basic low melting, nonviscous, clear liquid that reacts chemically with acidic lead exhaust components and physically wets particulate matter. Tests show that the size of the lead chloride particulates produced in laboratory generation experiments approximated those found in automobile exhaust. Author (USGRDR)

N71-13445# General Technologies Corp., Reston, Va.
INFRARED SPECTROSCOPIC STUDY OF GAS-SOLID INTERACTIONS Final Report
Edwin F. Rissman Durham, N.C. Natl. Air Pollution Control Admin. Apr. 1970 87 p refs
(Contract PHS-CPA-22-69-59)
(PB-194136; APTD-0586) Avail: NTIS CSCL 07D

The aim of the reported research was to apply infrared spectroscopic methods to handle large numbers of process control samples and to obtain kinetic information to evaluate the effects of variables such as sulfur dioxide concentration on overall process efficiencies and to understand the deadburning phenomenon associated with limestone processes for removal of sulfur dioxide from flue gases. Major effort was directed toward development of rapid reliable methods for analysis of reacted limestones. A solvent system, suitable for dissolving limestone and capable of being made infrared inactive by the dual cell technique was developed. The system of tetrasodium ethylene diamine tetrascetic acid saturated water was found to be the only one of a large number of systems investigated capable of dissolving limestone. Author (USGRDR)

N71-13446# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Separations Engineering Div.
SEPARATION OF Po-210 FROM BISMUTH BY LIQUID METAL DISTILLATION
R. F. Bradley, L. F. Landon, and G. W. Gobson Jun. 1970 39 p refs
(Contract AT(07-2)-1)
(DP-1222) Avail: NTIS

The research and development tests on laboratory and plantscale semiworks equipment that has established the engineering feasibility of using liquid metal vacuum distillation to separate up to 10 kg Po-210/year from irradiated bismuth are summarized. Author (NSA)

N71-13447# Bureau of Mines, Washington, D.C.
MATHEMATICAL EVALUATION OF SO2 SORPTION-REGENERATION REACTIONS WITH ALKALIZED ALUMINA

James H. Russell, Joseph W. Town, and Hal J. Kelly Aug. 1970 34 p refs Supplement to RI-7275 and to Ri-7414
(PB-193985; RI-7414; RI-7414-Suppl; RI-7275 Suppl) Avail: NTIS CSCL 07A

Alkalized alumina (an active form of sodium aluminate) has been considered as a sorbent for the removal of sulfur dioxide from industrial flue gases. Four rate equations, each based on a different mechanism, were compared with the results of thin-bed sorption tests. It was found that each equation agreed with the experimental results, within experimental variance, over most of the range of sorption studied. First-order rate equations were generally satisfactory in explaining both sorption and regeneration. It is concluded that the equations developed are adequate for the design of commercial fluidized beds for the sorption of SO2 from industrial flue gases and regeneration of the alkalized alumina. Author (USGRDR)

N71-13448# California Univ., Los Angeles. Dept. of Chemistry.
HIGH-PRESSURE RAMAN SPECTRA OF HEXAGONAL ZINC SULFIDE
Y. Ebisuzaki and M. Nicol [1969] 9 p refs Presented at the Meeting of the Am. Phys. Soc., Dallas, Mar. 1970 Revised
(Contract AT(11-1)-34)
(UCLA-34P88-28-Rev) Avail: NTIS

First and second-order Raman spectra of monocrystalline hexagonal zinc sulfide were measured from atmospheric pressure to 40 kbar at room temperature. Gruneisen parameters (−d ln v/d ln V) were determined for all of the observed modes; the values of the parameters range from 0.99 plus or minus 0.16 (LO) to 1.81 plus or minus 0.19 (TO) for the first-order spectrum and from −1.79 plus or minus 0.36 (180 cm/1 mode) to 2.38 plus or minus 0.14 (219 cm/1 mode) for the second-order spectrum. A 9% decrease of the low frequency dielectric constant from 1 atm to 40 kbar was calculated from the frequency shifts and the reported decrease of the high frequency dielectric constant. Author

N71-13449# Minnesota Univ., Minneapolis. Inst. of Tech.
DIFFUSION STUDIES IN LIQUID METALS Progress Report, 15 Jun. 1969 − 15 Jun. 1970
R. A. Swalin Jun. 1970 15 p refs
(Contract AT(11-1)-841)
(COO-841-20) Avail: NTIS

Research progress is reported on thermotransport in liquid Ag, self-diffusion in liquid In and Hg, and radial distribution functions of liquid K. Author (NSA)

N71-13450# Stanford Univ., Calif. Dept. of Chemistry.
MACROMOLECULES Final Scientific Report, 1 Jan. 1969 − 30 Jun. 1970
Paul J. Flory 24 Aug. 1970 14 p refs
(Contract F44620-69-C-0058)
(AD-712709; AFOSR-70-2460TR) Avail: NTIS CSCL 7/3

The research briefly discussed includes general theory of polymer chain configuration; optical properties of polymer chains; small angle X-ray scattering by chain molecules; properties of vinyl polymers in relation to molecular structure; properties of other polymers in relation to structure; studies on biopolymers; and thermodynamics of polymer solutions. Author (TAB)

N71-13451# Bureau of Mines, Washington, D.C.
COMPRESSIBILITY FACTORS FOR HELIUM AND CARBON DIOXIDE MIXTURES AT −10C AND −20C AND PRESSURES TO 1000 psia
G. W. Weems and A. R. Howard Jul. 1970 48 p refs
(PB-194003; RI-7412) Avail: NTIS CSCL 07D

The compressibility factors for helium and carbon dioxide mixtures at −10 and −20 C and pressures to 1,000 psia are presented. A Burnett apparatus was used. Data from the experiments were treated by the method of Barieau and Dalton. Tables of compressibility factors and approximations of the virial coefficients are presented for 10 binary mixtures as well as for helium and carbon dioxide. The results follow the same trend as data previously reported. Author (USGRDR)

N71-13452# Iowa State Univ. of Science and Technology, Ames.
BIBLIOGRAPHY OF MASS SPECTROSCOPY LITERATURE FOR THE FIRST HALF OF 1968, COMPILED BY A COMPUTER METHOD
J. Capellen, H. J. Svec, J. R. Jordan, and R. Sun, comps. Aug. 1970 463 p refs
(Contract W-7405-eng-82)
(IS-2059) Avail: NTIS

The bibliography covers the first half of 1968 and lists 4589 articles of interest to mass spectroscopists. A Bibliography section, an Author Index section, and a Key Word Out of Context Index (KWOC Index) section are included. The Bibliography section lists the authors' names and the reference numbers of their articles. The KWOC Index lists the key words, the reference numbers of the articles in which the key word appears, and the first 100 characters of the title. Author (NSA)

N71-13453*# Illinois Univ., Urbana. Coordinated Science Lab.
TUNNELING SPECTROSCOPY IN DEGENERATE p-TYPE SILICON
D. E. Cullen, E. L. Wolf, and W. Dale Compton Feb. 1970 50 p refs
(Contract NAS7-100; JPL-952363; DAAB-07-67-C-0198)
(NASA-CR-115789; AD-701873; UILU-ENG-70-202; P 457)
Avail: NTIS CSCL 07D

Tunneling in boron doped p-type silicon metal-semiconductor (MS) and metal-insulator-semiconductor (MIS) tunnel junctions has been studied at low temperatures by measuring the derivatives, dI/dV and the second derivative of I with respect to V, of the current-voltage characteristics as functions of applied bias voltage V. Junctions were prepared by evaporating metal contacts onto vacuum or air cleaved silicon surfaces. The general features of the tunneling conductance were found to be in qualitative agreement with existing theories of tunneling in semiconductors. Structure in the derivative data resulting from the interaction of tunneling electrons with silicon zone center phonons and boron local mode phonons has been observed. The optical phonon lineshapes in the most heavily doped MIS units are shown to compare well with the theoretical lineshapes in which modifications in the bulk semiconductor states arising from electron-optical phonon interactions in the semiconductor electrode have been included. The origin of the optical phonon and local mode phonon structure in samples of lower doping is not fully understood. Author (TAB)

N71-13454*# Translation Consultants, Ltd., Arlington, Va.
SAMPLING OF FRONTAL ANALYSIS AND DETERMINATION OF CARBON MONOXIDE [L'EMPLOI DE L'ANALYSE FRONTALE POUR L'ECHANTILLONAGE ET LE DOSAGE DE L'OXYDE DE CARBONE DANS L'AIR]
L. Dubois et al. Washington NASA Jan. 1971 10 p refs Transl. into ENGLISH from Mikrochim. Acta (Vienna), v. 27, no. 2, 1970 p 313-320
(Contract NASw-2038)
(NASA-TT-F-13434) Avail: NTIS CSCL 07D

Carbon monoxide can be measured in the low ppm range after conversion to methane and detection by flame ionization. The carbon monoxide measured in this manner, is first sampled by frontal analysis on a 5 A molecular sieve. This technique eliminates all problems encountered with conventional sampling on adsorbents such as water condensation, etc. Moreover, the volume of the sample does not need to be known. Lastly, all adsorbents used in gas

chromatography can be employed; one may select an adsorbant specific for each of the compounds to be measured. Author

N71-13455# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.
THE OXIDATION OF CARBON MONOXIDE/METHANE MIXTURES IN SHOCK WAVES
A. M. Dean and G. B. Kistiakowsky Aug. 1970 34 p refs Submitted for publication
(Contract Nonr-1866(36))
(AD-712531) Avail: NTIS CSCL 7/4

CO/O2/Ar mixtures with mole fractions of 4%/2%/94% and containing 180 or 500 ppm CH4 were investigated in incident shock waves at about 5 x 10 to the 17th particles/cc total concentration. The reaction was followed by measuring infrared emissions from CO2 and CO for about 1500 microsec particle time over the temperature range 1750 - 2575K. The rate of CO2 production initially increased exponentially and then became constant after several percent conversion. It was possible to quantitatively describe the observations in terms of a mechanism. Methane was found to be more effective than either H2 or H2O in promoting the branching chain oxidation of CO. Extending these observations, it is shown that extremely small concentrations of organic compounds can strongly influence many features of the CO/O2 system. Author (TAB)

N71-13456# National Bureau of Standards, Washington, D.C. Electrochemical Analysis Section.
ELECTROCHEMICAL ANALYSIS SECTION: SUMMARY OF ACTIVITIES, JULY 1969–June 1970
Richard A. Durst, ed. Nov. 1970 92 p refs
(NBS-TN-543) Avail: SOD $1.00

An attempt is made to briefly summarize a year's progress on the technical projects of the Section, to indicate the composition and capabilities of the unit as a whole, and to stress the Section's role in the mission of the Institute. Summaries of the work in each of the Section competences are given. In the area of acidity measurements, work continued on the standardization of tris(hydroxymethyl)aminomethane for use as a biologic pH buffer material and standard for clinical pH measurements. Progress toward reference standards for the calibration of ion-selective electrodes is reported including pM and pCl values for both NaCl and KCl. A study using the silver sulfide ion-selective electrode for measuring trace silver ion losses due to adsorption on selected surfaces is described. High-precision coulometry is used to determine the atomic weight of zinc, the purity of EDTA, and the stoichiometry of gallium arsenide. Author

N71-13457# National Bureau of Standards, Washington, D.C. Spectrochemical Analysis Section.
ACTIVITIES OF THE NBS SPECTROCHEMICAL ANALYSIS SECTION, JULY 1969–JUNE 1970
Bourdon F. Scribner, ed. Nov. 1970 116 p refs
(NBS-TN-542) Avail: SOD $1.25

Spectrochemical research activities, improvements in equipment, and applications, especially to the certification of NBS Standard Reference Materials, are summarized. In electron probe microanalysis, a comprehensive computer correction program for accurate analysis of materials relative to single elements or simple compounds was developed, an improved lithium-doped silicon detector was found to provide increased resolution, and improvements in microprobe instrumentation produced a high level of stability. Studies of procedures for correction of X-ray fluorescence measurements were made, instrumental changes resulted in marked improvement in performance reliability, and new applications were made. In optical emission spectrometry, studies were made of beryllium determination in an air pollution investigation and trace analyses were made of organic materials to parts per billion limits. Methods of pre-concentration of impurities are described for optical emission and isotope dilution spark source mass spectrometric analysis of ingot iron, botanical materials, and high purity reagents. Author

N71-13458# Florida Univ., Gainesville. Radiation Chemistry Group.
SPC-12 MASS SPECTROMETER ROUTINES: REAL TIME DATA ACQUISITION AND DATA REDUCTION FOR BENDIX T-O-F INSTRUMENTS
M. B. Fallgatter and R. J. Hanrahan Mar. 1970 21 p
(Contract AT(40-1)-3106)
(ORO-3106-33) Avail: NTIS

A General Automation SPC-12 computer-based data acquisition and reduction system for a Bendix model 14 time-of-flight mass spectrometer for routine analysis of chemical products resulting from gamma radiolysis of organic compounds and related research is described. NSA

N71-13459# Oak Ridge National Lab., Tenn.
STUDIES OF THE SUPEROXIDE ION AND OTHER SOLUTE SPECIES IN MOLTEN FLUORIDES
Fred L. Whiting (Ph.D. Thesis--Tenn. Univ., Knoxville) Aug. 1970 79 p refs Sponsored in part by NSF and AEC
(TID-25480) Avail: NTIS

The existence of O(-)2 ion in molten LiF-KF at 500 C was established. The absorption spectrum of O(-)2 in molten LiF-NaF-KF at 500 C consists of a band at 254 nm. The band position for the O(-)2 ion was found to be at 252 nm in liquid ammonia. Raman spectral results show the vibrational frequency of the O(-)2 ion in molten LiF-NaF-KF to be at 1107 + or - 3 per centimeter. A novel voltammetric-spectrophotometric technique was employed in an attempt to obtain the spectra of some high oxidation state species in molten LiF-NaF-KF. The species were generated at a microelectrode positioned in the optical aperture of a captive liquid cell. The utility of the method was demonstrated by obtaining a spectrum of U(III) generated by the reduction of U(IV) in molten LiF-BeF2-ZrF4 at 540 C. The spectrum of the U(IV)-U(III) mixture is given. Author (NSA)

N71-13460# Bureau of Mines, Washington, D.C.
SORPTION OF SO2 AND REGENERATION OF ALKALIZED ALUMINA IN FLUIDIZED-BED REACTORS
Jack I. Paige, Joseph W. Town, James H. Russell, and Hal J. Kelly Aug. 1970 37 p refs
(PB-193984; RI-7415) Avail: NTIS CSCL 07A

Two fluidized bed reactors were designed, built, and operated, one as a sorber for SO2 and the other as a contactor for the regeneration of the sulfur laden alkalized alumina (NaAlO2). The target of 90 percent removal of SO2 from a flue gas stream containing 0.3 percent SO2 was attained by using a sorbent feed of 10 to 15 grams per minute into a 5 inch bed depth of alkalized alumina. The sorption unit was operated at about 330C. Complete regeneration of the laden alkalized alumina containing 5 to 10 percent sulfur was accomplished in approximately 1/2 hour. An excess of reformed propane at about 730C was the regenerating gas. Data from these tests demonstrate, within experimental error, the validity of equations developed from short term, thin bed tests related to sorption and regeneration rates. Author (USGRDR)

N71-13461* GCA Technology Div., GCA Corp., Bedford, Mass.
ANALYTICAL PHOTOIONIZATION MASS SPECTROMETER WITH AN ARGON GAS FILTER BETWEEN THE LIGHT SOURCE AND MONOCHROMETER Patent
Walter P. Poschenrieder, James A. R. Samson, and Peter Warneck, inventors (to NASA) Issued 21 Jul. 1970 (Filed 20 Feb. 1968) 7 p Cl. 250-41.9; Int. Cl. B01d59/44; Int. Cl. H01j39/34
Sponsored by NASA

(NASA-Case-LAR-10180-1; US-Patent-2,521,054; US-Patent-Appl-SN-709398) Avail: US Patent Office CSCL 07D

A photoionization mass spectrometer was developed and used to detect pollutants in natural air by providing a light beam source that can discriminately ionize pollutants in a mixture with the naturally occuring masking constituents. Detailed drawings of the system are included. E.H.W.

N71-13462# Asian Inst. of Tech., Bangkok (Thailand).
THE HARVESTING OF ALGAE THROUGH CHEMICAL FLOCCULATION AND FLOTATION
Elma D. Batallones (M.S. Thesis) 1970 108 p refs
(Rept-321) Avail: NTIS

The feasibility of chemical flocculation and air flotation for harvesting of algae from high rate oxidation pond waters was investigated. Several coagulants were tested, aluminum sulfate, lime, ferrous sulfate, ferric sulfate, ferric chloride, and fifty organic commercially available polyelectrolytes. Among the five primary coagulants, alum was found to be the best on an economic basis. Purifloc C31, C32, and PEI 600 were noted to be effective coagulant aids to alum flocculation. Coagulation was carried out using the conventional jar test technique. Effects of the factors to the process such as coagulant dose, pH, mixing conditions, polyelectrolyte concentration, and time of addition of polyelectrolyte were determined. Alum flocculation was found to be optimum on an economic basis at pH 6.5. Author

N71-13463*# Translation Consultants, Ltd., Arlington, Va.
USE OF POTASSIUM SUPEROXIDE IN THE REGENERATION OF EXHALED GASES [UTILISATION DU SUPEROXYDE DE POTASSIUM DANS LA REGENERATION DES GAZ EXPIRES]
P. Ganas Washington NASA Jan. 1971 33 p refs Transl. into ENGLISH from French Rept. Presented at the 26th Meeting of the Aerospace Med. Panel, AGARD, Paris, 21-24 Oct. 1969
(Contract NASw-2038)
(NASA-TT-F-13430) Avail: NTIS CSCL 07D

The problem of regenerating artificial respirable atmospheres is discussed. A model of an apparatus for self contained and individual respiration using potassium superoxide for regeneration of exhaled gases is presented. Research and development efforts leading to the development of operational cartridges using tablets of potassium superoxide are described. Performance data of the individual unit are presented. Author

N71-13464*# Bradford Univ. (England). School of Chemistry.
THE FORMATION OF SURFACE FILMS BY ELECTRON BOMBARDMENT Final Report, Oct. 1969 – Sep. 1970
M. W. Roberts, J. R. H. Ross, J. H. Wood, W. J. Murphy, and S. J. Frost Oct. 1970 77 p refs Prepared for TRW Systems Group, Redondo Beach, Calif.
(Contract NAS7-717)
(NASA-CR-115848) Avail: NTIS CSCL 20G

The mechanism of formation and the properties of thin organic polymeric films prepared by the electron beam polymerisation process are considered. Work carried out to characterize the reactions occurring in the tungsten emitting filament during the polymerization process is described; both W2C and WC are formed, and changes occur in the apparent thermionic work function of the emitter. Although the thermionic work function of the carburised tungsten is much lower than that of tungsten, it is shown that the average work function is higher. The characterization of rhenium as an emitting filament is also discussed. Although rhenium has previously been thought not to form carbides, the present results indicate that a carbide is formed. The results of studies of the surface properties of thin polymer films prepared under various conditions from perfluorobutene-2 are presented. Variation of the reaction conditions causes very considerable changes in the surface characteristics. Author

N71-13465# California Univ., Los Angeles. Dept. of Chemistry.
PHOTOSENSITIZED AQUATION REACTIONS OF Cr(NH3)5NCS(2+)
John E. Martin and Arthur W. Adamson [1969] 30 p refs
(USC-113-P-10-X-1) Avail: NTIS

A preliminary study determined that it was possible to photosensitize reactions of Cr(III) complexes and the results are presented for aqueous Cr(NH3)5NCS(2+). The two principal sensitizers used were acridinium ion and biacetyl. The findings suggest that acridinium sensitizes both ammonia and thiocyanate aquation, the presence of oxygen affecting the latter but not the former mode. The kinetics of the fluorescence quenching by the complex and that of the sensitized ammonia aquation indicate that the latter process is induced by the first singlet excited state of acridinium ion, along with a small component of thiocyanate aquation. It is concluded that, in this system, the singlet excited state of acridinium ion populates the first quartet excited state of the complex ion while the triplet state populates the double excited state of the complex. D.L.G.

N71-13466*# Techtran Corp., Glen Burnie, Md.
METHOD OF PREPARING FINELY POROUS POLYURETHANE PLASTICS
J. G. Frielink Washington NASA Dec. 1969 12 p refs Transl. into ENGLISH from the Dutch Patent no. 6704182
(Contract NASw-1695)
(NASA-TT-F-12734) Avail: NTIS CSCL 07D

A process for the preparation of finely porous polyurethane elastomers from polyhydroxyl compounds, polyisocyanates, with or without halogen substituted hydrocarbons, catalysts, and other usual additives, with shaping in a single stage or a two stage process is discussed. Author

N71-13467# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
FILM FORMATION FROM POLYMER DISPERSIONS
S. L. Bertha and R. M. Ikeda [1970] 11 p refs *Its* Publ. Proposal No. 279W
Avail: NTIS

Coalescence of latex particles was attributed to pressure produced by negative curvature of the polymer surface with air and water and capillary action. It was shown that rapid coalescence of poly (vinylidene chloride/methyl acrylate/acrylic acid, 80/20/5, wt.) latex occurs only above Tg. Analysis of the forces indicates that none is sufficient to cause coalescence below Tg while any, or all may cause coalescence above Tg. Author

N71-13468# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.
RADIATION EFFECTS ON THE SYSTEMS PENTANE THIOL/CUMOL OR TERTIARY BUTYL BENZOL/OXYGEN OR ARGON [DIE SYSTEME PENTANTHIOL/CUMOL ODER TERT. BUTYLBENZOL/SAUERSTOFF ODER ARGON BEI EINWIRKUNG VON STRAHLUNG]
Eckhard Zoerkendoerfer (Ph.D. Thesis) 1970 162 p refs In GERMAN
Avail: NTIS

The behavior of pentane thiol solutions in ethyl benzene, cumol, and tertiary butyl benzene during gamma and ultraviolet irradiation was studied. A gas chromatographic technique was developed for the analyses of reaction compounds. Evaluation of pentane thiol decrease and formation of 6,7-dithia dodecanes in relation to irradiation, solvent, and gas flow showed that: (1) ultraviolet as well as gamma irradiation in the presence of oxygen obtained larger reactions; (2) both irradiations gave better results with oxygen present in cumol, but with argon present in tertiary butyl benzene; and (3) the ultraviolet irradiation from a low-pressure mercury source was more effective than that from a high-pressure mercury source. Transl. by G.G.

N71-13469# Technische Hochschule Hannover (West Germany). Fakultaet fuer Natur- und Geisteswissenschaften.
ON THE REACTION OF CARBON TETRACHLORIDE WITH COMPLEX TRANSITION METAL FLUORIDES IN PACKET BEDS [ZUR UMSETZUNG VON TETRACHLORKOHLENSTOFF MIT KOMPLEXEN FLUORIDEN DER UEBERGANGSMETALLE AM FESTBETT]
Peter E. Horn (Ph.D. Thesis) 1970 220 p refs In GERMAN
Avail: NTIS

Carbon tetrachloride vapor flow through packed beds of complex transition metal fluoride pellets was used to produce fluorohalogen methanes of the Kryolith-type A3MeF6 and of the Perowskit-type AMeF3. Reaction kinetics were analyzed by application of the ligand field theory to observed halogen exchange reactions and then used to determine the individual thermal stability of each fluoro compound as well as the effects of thermal instabilities on the exchange reactions of chlorine against fluorine. Also considered were moisture effects on the chemical reactions. It was shown that the reaction of a fluoro complex with water produced hydrofluoric acid and increased fluoromethane yields in carbon tetrachloride reactions with complex fluorides markedly. Reaction kinetics for carbon tetrachloride diffusion on K3FeF6 and KZnF3 were used to determine temperature dependences and velocity constants of activation energies. Transl. by G.G.

N71-13470# Du Pont de Nemours (E. I.) and Co., Richmond, Va. Spruance Film Research and Development Lab.
DIRECT ANALYSIS OF RESIDUAL SOLVENTS IN FILMS BY GAS CHROMATOGRAPHY
M. S. Sahli [1969] 12 p refs *Its* Publ. Proposal No. 280-CE
Avail: NTIS

Previously published methods of residual solvent analysis in coated or treated films are summarized. This method utilizes an instrument (Film Sample Injector) built for this purpose to eliminate any limitations imposed on previous methods. The injector provides fast, accurate, and direct analysis of residual solvents by placing the film sample in the injection port and removing it easily at the end of the test. The injector can be utilized easily for paper and fiber analysis. Experimental details are included. Author

N71-13471# Los Alamos Scientific Lab., N.Mex.
FORMATION OF A SOLID SOLUTION OF LITHIUM FLUORIDE AND LITHIUM HYDRIDE
H. Hahn et al Jul. 1970 4 p refs Transl. into ENGLISH from Z. Anorg. Allg. Chem. (East Ger.), no. 372, 1970 p 248 Prepared by McElroy (Ralph) Co., Austin, Tex. for Los Alamos Sci. Lab.
(LA-tr-70-16) Avail: NTIS

Results of an investigation show that lithium fluoride and lithium hydride form a solid solution at 700 C extending from 0 to 60 moles percent LiH and showing an expansion of the LiF lattice. Author

N71-13472# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANISM OF THE ADSORPTION OF AMINE-TYPE CORROSION INHIBITORS
S. Fujii et al 28 May 1970 18 p refs Transl. into ENGLISH from 3d Mezhdunarodnyi Kongress Korrozii Metallov (USSR), v. 2, 1968 p 69–78
(AD-710295; FTD-HT-23-206-70) Avail: NTIS CSCL 7/4

The chemisorption of amine-type inhibitors was investigated. It is presumed that amines extract the adsorbed water from the metal surface and occupy the respective vacant sites forming a chemisorbed inhibitor film. The dehydrating effect of amines is attributed to H bonding, while chemisorption involves electron pair donation from the adsorption-active functional group (N) to the electron-depleted dehydrated metal surface. Experiments were carried out with dimethylcetyl amine-CCl4 soins. Reduced and annealed at 500 degrees during 24 hrs. in H atm., Fe powder was coated with the amine-type inhibitor by immersion in the CCl4 soln. in a He atm. Corrosion rate was determined by the amount of evolved H. Amines are considered both as efficient dehydrating agents and film-forming organic compounds. The excellent inhibition of Fe is attributed to a dual mechanism inherent to amines. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-13474*# Martin Marietta Corp., Denver, Colo.
PCM TELEMETRY FOR EARTH RESOURCES AIRCRAFT. END ITEM TEST REPORT, CONTRACT ITEM NO.1
Duane L. Starner Jun. 1969 76 p
(Contract NAS9-8146)
(NASA-CR-108700; MCR-69-286) Avail: NTIS CSCL 09F

Electrical and environmental qualification tests performed on the first PCM production system, and the acceptance testing of other system elements. Author

N71-13475*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT RESULTS OF A 2500-FOOT-PER-SECOND REENTRY EXPERIMENT USING MICROWAVE REFLECTOMETERS TO MEASURE PLASMA ELECTRON DENSITY AND STANDOFF DISTANCE
William L. Grantham Washington Dec. 1970 92 p refs
(NASA-TN-D-6062; L-7107) Avail: NTIS CSCL 22C

Results of a reentry plasma diagnostic experiment made at a velocity of 25,000 ft/sec (7.62 km/sec) are compared with theoretical flow-field values at four locations on the spacecraft. Flow-field plasma properties were inferred from measurements obtained with a four-frequency microwave reflectometer having an electron density measurement range from approximately 10 to the 10th power to 10 to the 13th power electrons/cu cm. Good correlation exists between the reflectometer-determined plasma values and those obtained from electrostatic probes and other flight data taken. Measured and computed plasma electron densities in the nose region generally agree except at low altitudes. In the aft flow-field region, a substantial region density level difference is indicated at the higher altitudes, which is attributed to ambipolar diffusion mechanisms not included in the theoretical flow-field model. Plasma standoff distance measurements indicate strong electron density gradients near the vehicle surface, as expected from sheath calculations. At altitudes below about 100,000 ft (30.48 km), the interpretation of reflectometer data becomes more difficult because of the high electron-neutral collision frequency and the changes in antenna length caused by heat-shield ablation. Author

N71-13476*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
APPARATUS FOR STUDYING THE PROPERTIES OF ANTENNAS IN AN EFFECTIVELY INFINITE DISSIPATIVE MEDIUM
Larry D. Scott Dec. 1969 90 p refs
(Grant NGR-22-007-056)
(NASA-CR-115817; SR-6) Avail: NTIS CSCL 09E

Experimental equipment is designed and techniques are developed which allow relatively thin (h/a approximately 20 to 200) linear antennas to be studied in effectively infinite, homogeneous, isotropic media. The derive point admittance for ten antennas of

Beta(h) approximately 0.3 to 3.3 is measured in six media for which alpha/Beta are approximately 0 to 1. Measured current and charge distributions are also presented. Techniques are developed to more accurately measure the electrical properties of the dissipative media. Drive point junction effects are also considered. Author

N71-13477*# Martin Marietta Corp., Denver, Colo.
PCM TELEMETRY FOR EARTH RESOURCES AIRCRAFT. End Item Test Report; Contract Item Numbers 2, 3, and 7
Duane L. Starner Jul. 1969 7 p
(Contract NAS9-8146)
(NASA-CR-108701; MCR-69-376) Avail: NTIS CSCL 09F

The PCM Telemetry System consists of two basic units, the Control/Combiner Unit (CCU) and the Multiplexer Encoder Unit (MEU). A complete system is comprised of one CCU and up to four MEU's. The CCU provides the system timing signals and provides a flexible telemetry formatting capability via plug-in cards. Each MEU can accept 60 differential 0–5 volt analog signals which it converts to 10 bit binary words, and 60 differential bilevel signals grouped as six 10 bit words. The A/C conversion accuracy is +0.1%. The system was electrically tested to verify all specification requirements of the contract, including such tests as accuracy, input and output impedance, and frequency stability. The system was also subjected to vibration, temperature/altitude, and electromagnetic interference environments. Author

N71-13478*# Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
MULTIPATH STUDY FOR A LOW ALTITUDE SATELLITE UTILIZING A DATA RELAY SATELLITE SYSTEM Final Report
Dennis Eggert Oct. 1970 112 p refs
(Contract NAS5-11602)
(NASA-CR-115813; SSD-00513R) Avail: NTIS CSCL 22B

The transmission of electromagnetic energy between a low-altitude satellite (LAS) and a data relay satellite (DRS) at geostationary altitude is discussed. For this study, low altitudes are in the 100 to 1000 mile range. There are basically two paths between the satellites direct path, and a path by reflection from the earth's surface. The total reflecting surface may be thought of as being composed of many smaller reflecting surfaces, and hence, the total reflection path is a collection of many reflection paths. The signal received via the reflection path is delayed and distorted with respect to the received direct signal, resulting in an undesirable interference. Further, under frequently occurring conditions, the magnitude of the received reflected signal may be larger with respect to the direct signal power. It is shown that, for a range of geometrical conditions and a transmission frequency of 140 MHz over the sea, the average reflected power incident on the receiving antenna will be only 2 dB less than the direct signal power. Interference of this magnitude has rather profound consequences on a communication system operating in this environment. Author

N71-13479*# Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
STUDY OF A LOW ALTITUDE SATELLITE UTILIZING A DATA RELAY SATELLITE SYSTEM, PHASE 2 Final Report
Dennis Eggert Aug. 1969 151 p ref
(Contract NAS5-11602)
(NASA-CR-115814; SSD-90283R) Avail: NTIS CSCL 17B

The technical considerations associated with a low altitude satellite (LAS) operating in conjunction with a data relay satellite system (DRSS) are discussed. The study was conducted in two phases. Phase I consisted of analysis and trade studies dealing with LAS-DRSS communication and with LAS subsystems. Phase II consisted of a spacecraft conceptual design based upon the results of Phase I. The satellite concept developed during Phase II is presented. Author

N71-13480# National Severe Storms Lab., Norman, Okla.
SPECIAL RADAR PROJECTS AT THE NATIONAL SEVERE STORMS LABORATORY: THE R-METER Final Report, 1 Jul. 1968–1 Apr. 1970
Dale Sirmans Sep. 1970 29 p refs
(Contract FA-68-WAI-148)
(FAA-RD-70-78) Avail: NTIS

The power returned from a random distribution of scatterers moving relative to each other fluctuates about its mean at a rate proportional to the width of the velocity spectrum. The average crossing rate can be observed with an incoherent radar and the velocity spectrum width inferred if the spectra are not spuriously broadened by system instability. However, tolerable levels of stability are not normally achieved in practice with most incoherent radar systems such as the WSR-57 and the CPN-18. Another source of error in crossing rate measurements is receiver noise; this limits quantitative measurement of the crossing rate to signals whose mean is 20 dB or more above the noise unless a correction is made. Relationships among crossing rate, meteorological parameters, and radar characteristics are derived for several models of interest. Crossing-rate-processing of radar echo data continues to be an attractive concept, although further consideration of attendant problems is indicated. Author

N71-13481# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
AN/PPS-18 (XN-1) ULTRA RELIABLE RADAR, PHASE 2 Interim Development Report, 1–31 Aug. 1970
J. D. Frattura 8 Sep. 1970 23 p refs
(Contract N00039-70-C-3502)
(AD-712525) Avail: NTIS CSCL 17/9

The report covers the tenth month of design and development activity during Phase 2 of the AN/PPS-18 (XN-1) Ultra Reliable Radar Program. General program progress and status is presented along with the detailed report of progress for the receiver subcontract. Author (TAB)

N71-13482*# National Aeronautics and Space Administration, Washington, D.C.
TRACKING AND DATA ACQUISITION: NEWS RELEASE
Dec. 1970 11 p
(NASA-TM-X-66529) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 22A

The Office of Tracking and Data Acquisition is NASA's eyes, and ears and its memory. OTDA provides the electronic pipeline from all points around the Earth, for flights at great distances and small. Networks of ground stations and air- and sea-borne equipment provide precision tracking, communication, and data collection. As a major counterpart to other elements of NASA and U.S. and foreign space interests, the OTDA program has its own staff funds, installations and equipment. OTDA serves an endless variety of experiments in the air and space, because the research and development programs of NASA, by their nature, constantly change in volume, scope and purpose and no two projects are alike. This work is broadly classified and organized to deliver information to and from every experiment conducted anywhere that NASA's flights go. Author

N71-13483# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
PROBABILITY OF ERROR FOR ORTHOGONAL SIGNALS ON A FADING WHITE GAUSSIAN CHANNEL
N. T. Gaarder Sep. 1970 36 p refs
(Grant AF-AFOSR-1251-67)
(AD-712707; AFOSR 70-2490TR) Avail: NTIS CSCL 9/4

The probability of error for binary permutation modulation, a generalization of orthogonal signals, for white Gaussian fading channels is considered. The emphasis is on the limiting behavior of P sub e for large transmitter memories. By using a discrete

channel model, upper bounds on the probability of error are found in a simple straightforward manner. These bounds indicate that as long as the transmitter rate is less than the capacity of an additive white Gaussian channel, the ratio of average received signal power to noise power per Hertz, the probability of error decreases exponentially with increasing transmitter memory. Author (TAB)

N71-13484# Weather Bureau Silver Spring, Md. Systems Development Office.

LOCAL-USE/GAP-FILLER RADAR DESIGN ANALYSIS

Kenneth H. Shreeve Feb. 1970 72 p refs

(Rept-2) Avail: NTIS CSCL 17/9

The Weather Bureau has about 60 radars of the WSR-1, 3 and 4 type in operation, that are fast wearing out and need to be replaced. Some of these radars are being replaced with the WBRR slow scan radar remoting systems where the sites are within the coverage of a WSR-57 network radar facility. That approach, however, will not satisfy all requirements for local-use radar. Also, in addition to the problem of replacing old WSR-1, 3 and 4 radars, there is a need to fill the gaps in the network of the WSR-57 radars, especially in the mountainous West. Thus, there is need for approximately 25 modern local use gap filler radars. Based on an in-depth analysis of the cost and performance of various features of radar systems, four basic options representing the range of Weather Bureau were configured. Once a basic option has been selected, the report contains enough information to prepare the specifications necessary for the procurement of local use gap filler radar systems. Author

N71-13485# RAND Corp., Santa Monica, Calif.

THE MOLIERE APPROXIMATION FOR WAVE PROPAGATION IN TURBULENT MEDIA

G. Modesitt Sep. 1970 14 p refs

(Contract DAHC15-67-C-0141; ARPA Order 189-1)

(AD-712456; RM-6325-ARPA) Avail: NTIS CSCL 20/6

A solution is presented to the wave propagation equation obtained by direct analogy from a method commonly used to solve the Schrodinger equation for high-energy potential scattering. In optical communications and related devices, the random variations in the received signal due to atmospheric turbulence can represent a severe limitation to system performance. Studies of these fluctuations have been based on solutions to the wave propagation equation that are correct only to the first order in the refractive index deviation. This memorandum demonstrates a solution that is correct to all orders in the refractive index deviation and to lowest order in the stationary phase approximation. Although the solution is readily extended to next order in stationary phase, such an extension is recognized in scattering theory as unwarranted since it neglects terms of the same order from outside the region of stationary phase. The conventional Born and Rytov solutions in propagation theory are of questionable validity since they represent approximations to the extended solution. Author (TAB)

N71-13487*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.

INVESTIGATION OF ZERO-CROSSINGS AS INFORMATION CARRIERS

Arthur L. Fawe and Robert R. Boorstyn 1969 120 p refs

(Grant NGR-33-006-040)

(NASA-CR-115816; PIBEE69-005) Avail: NTIS CSCL 17B

The transmission of a signal bandlimited to (−W, + W) by the zero-crossings of the optimum signal, y(t), is considered. A computer algorithm to estimate y(t) from its zero-crossing in a finite time interval is described. It is shown that as the channel bandwidth increases the output signal-to-noise-ratio for the clipped version of the optimum signal tends to an exponential function of the channel signal-to-noise ratio. A similar behavior is obtained for x(t) itself. Author

N71-13488# Hamburg Univ. (West Germany). Inst. fuer Radiometeorologie und Maritime Meteorologie.

DIURNAL VARIATION AND TIDAL DEPENDENCE OF THE RECEIVED FIELD STRENGTH ON RADIO LINKS IN THE GERMAN BIGHT [TAGESGANG UND GEZEITENABHAENGIGKEIT DER EMPFANGSFELDSTAERKE AUF RICHTFUNKSTRECKEN IN DER DEUTSCHEN BUCHT]

H. W. Fruechtenicht 1968 57 p refs In GERMAN; ENGLISH summary

(Rept-13) Avail: NTIS

Field strength measurements on 7 GHz-, 2 GHz-, 600 MHz-, and 160 MHz-links were used for investigations of the diurnal variation of field strength over the Bight. The tidal influences on the propagation conditions are also considered. Especially during the summer months a daily period of the field strength is found. The minimum occurs in the morning and the maximum in the late afternoon and in the evening. The amplitude decreases with increasing wavelength. On the 7 GHz-link the 10%-values have nearly the same diurnal variation as the arithmetic means. On the three longer wavelengths the daily amplitude of the 10%-values is much larger than that of the arithmetic means. Linked with this amplitude c is the diurnal variation of the deviation of field strength, which is similar to the diurnal variation of the 10%-values on the 2 GHz-, 600 MHz-, and 160 MHz-paths. Mainly on the GHz-links there may be also observed a diurnal variation of the fading, that means the slow fading types are found more frequently in the evening and in the night. In general it is detected, that especially on the three longer wavelengths the mean diurnal variation, the diurnal variation of the 10%-values, and the diurnal variation of the deviation are influenced rather considerably by those field strength datas which occur during a slow fading. Two characteristic types of diurnal variation of field strength can be proved by examining the meteorological conditions, which exist in the area where the measurements were carried out. These two types are different in their cause of origin. In one case the diurnal variation of the received field is caused by a corresponding diurnal variation of the evaporation duct. The second type, which is mostly observed during anticyclonic weather conditions, is established by the daily formation and disintegration of advection ducts. Author

N71-13489# Hamburg Univ. (West Germany). Inst. fuer Radiometeorologie und Maritime Meteorologie.

AIRCRAFT MEASUREMENTS OF REFRACTIVE INDEX AND TEMPERATURE IN THE RANGE OF RADIO TRANSHORIZON LINKS OVER SEA [MESSUNGEN DER BRECHUNGS INDEX- UND TEMPERATURSCHICHTUNG IM BEREICH VON RICHTFUNKSTRECKEN. ERGEBNISSE VON FLUGZEUGAUFSTIEGEN UEBER DER DEUTSCHEN BUCHT]

H. Mueller 1968 73 p refs In GERMAN; ENGLISH summary

(Rept-12) Avail: NTIS

The refractive index and temperature measurements conducted during fall 1962 over the Bay of Heligoland are reported. The refractive index was measured by a microwave refractometer of NBS type, model 3A, the temperature by a platinum resistance thermometer. Moreover, static and dynamic pressure (determination of altitude and speed of the aircraft) were measured by special pressure transducers. The equipment, the calibration of the instruments and the methods of evaluation are described. There were two objectives of the measurements, namely: to obtain a survey of the mean vertical refractive index and temperature distribution under various weather conditions; and to obtain the power spectrum of the refractive index inhomogeneities as a function of height and atmospheric stability. Author

N71-13702# Sylvania Electronic Systems-East, Needham, Mass.

ELF PROPAGATION Review Paper

Janis Galejs *In* AGARD Electromagnetics of the Sea Nov. 1970 12 p refs (See N71-13901 04-23)

Avail: NTIS

Lightning discharges appear as principal sources of radiation in the ELF range; time variations of typical currents determine the effective dipole moment of sources and the shape of the radiated waveforms. Amplitude statistics of a source are related to the statistics of atmospheric noise. After reviewing the fundamental field representations propagation characteristics are calculated for a number of stratified and anisotropic model ionospheres. The resonances of the earth to ionosphere is analyzed in a symmetrical geometry, which is adequate for explaining observed resonance frequencies, Q-factors, power spectra, diurnal variations of power, and changes of resonance frequencies. The split modes that result from differences between normal day and night hemispheres are of negligible amplitudes. In an open ocean fields exhibit an exponential decay with increasing depth, but in the vicinity of the shore line the fields tend again to increase in the vicinity of the bottom surface. Waves cause signal fluctuations in a submerged reception. For large waves and the higher frequencies the signal fluctuates corresponding to the changes of the instantaneous depth above the receiving antenna. For small waves and lower frequencies the signal fluctuations are determined by surface characteristics in a finite area above the receiver. Author

N71-13703# Environmental Science Services Administration, Boulder, Colo. Research Labs.

PROPAGATION OF VLF ELECTROMAGNETIC WAVES ACROSS LAND/SEA BOUNDARIES

James R. Wait *In* AGARD Electromagnetics of the Sea Nov. 1970 12 p refs (See N71-13701 04-23)

Avail: NTIS

Considered is a two-dimensional model of propagation of radio waves in the earth ionosphere waveguide across a land/sea boundary. The surface impedance of the outer wall is uniform but there is a discontinuity in the surface impedance for the lower wall. Following a Wiener-Hopf procedure, the dual integral equations for the problem are solved exactly. Various limiting forms of the solution are discussed. In particular, it is shown that the exact expression for the mode conversion coefficient is closely related in form to the result obtained by Kirchhoff theory. The numerical results show that a land/sea boundary may cause excessive conversion of energy from the dominant to the higher modes. The resulting interference pattern can have serious consequences in VLF phase navigation systems. Author

N71-13704# Institut d'Optique Theorique et Appliquee, Paris (France). Groupe d'Etudes sur la Diffraction IO-ESE.

PROPAGATION OF ACOUSTIC OR ELECTROMAGNETIC WAVES IN AN INHOMOGENEOUS SEA-TYPE MEDIUM WITH ROUGH FRONTIERS

Marie France Verhaeghe and Armand Wirgin *In* AGARD Electromagnetics of the Sea Nov. 1970 13 p refs (See N71-13701 04-23)

Avail: NTIS

The propagation of acoustic or electromagnetic waves in the sea is discussed. The latter is considered as an inhomogeneously-filled waveguide with rough non-opaque frontiers. The inhomogeneity of the sea is taken into account by considering the waveguide to be filled with a number of horizontal piecewise homogeneous layers separated by flat or perturbed interfaces which are mutually parallel to each other in the mean. A homogeneous plane wave propagates towards the sea in the air which is considered as a homogeneous medium extending upwards towards infinity. Similarly, the earth's crust is treated as a homogeneous medium extending downwards toward infinity. The interaction of the wave field at each interface is examined by a perturbation method based on the assumptions that the spatial frequency spectrum of the interface profiles have a high spatial frequency cutoff and that the smallest spatial period of the interface profiles is large compared to the wavelength in air of the incident monochromatic wave. Numerical results pertaining to the extent of diffraction effects are given for a model of the sea consisting of a homogeneously filled waveguide with periodically rough walls. Author

N71-13705# Lille Univ. (France).

RADIATION FROM ELECTROMAGNETIC SOURCES PLACED IN ABSORBING MEDIA: ANALYTIC BIBLIOGRAPHY [RAYONNEMENT DES SOURCES ELECTROMAGNETIQUES PLACEES DANS DES MILIEUX ABSORBANTS ANALYSE BIBLIOGRAPHIQUE]

Robert Gabillard, Pierre Degauque, and James R. Wait (ESSA, Boulder, Colo.) *In* AGARD Electromagnetics of the Sea Nov. 1970 22 p refs In FRENCH (See N71-13701 04-23)

Avail: NTIS

This comprehensive literature review on electromagnetic radiation from sources in absorbing media contains a list of 424 reference articles. The collection is not complete because it does not include authors from Eastern Countries. Selection is based on the importance of studies undertaken after the beginning of the 20th century in order to understand the mechanism that rules electromagnetic wave propagation in ground and sea. Experimental and theoretical work is briefly outlined and titles and references are presented in chronological order. Transl. by G.G.

N71-13706# Lille Univ. (France).

ANTENNA RADIATION IN ABSORBING MEDIA A Review [RAYONNEMENT DES ANTENNES PLACEES DANS DES MILIEUX ABSORBANTS: Revue]

Robert Gabillard, Pierre Degauque, and James R. Wait (ESSA, Boulder, Colo.) *In* AGARD Electromagnetics of the Sea Nov. 1970 24 p refs In FRENCH (See N71-13701 04-23)

Avail: NTIS

Considered are performances of antennas placed in absorbing homogeneous media. Studied were cases where wave propagation took place in very homogeneous media separated by planes. This constituted the ideal theory for a truly heterogeneous medium as formed by the sea in a stratified terrain below the atmosphere. Disregarded are earlier classical studies in order to obtain a clear projection. Transl. by G.G.

N71-13707# Centre d'Etudes Theoriques de la Detection et des Communications, Paris (France).

ACCURATE METHOD FOR COMPUTING THE CURRENT DISTRIBUTION ON AN ANTENNA [METHODE DE CALCUL EXACTE DE LA REPARTITION DES COURANTS SUR UNE ANTENNE]

Maurice Bouix *In* AGARD Electromagnetics of the Sea Nov. 1970 4 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)

Avail: NTIS

Based on the definition of the pinpoint electromagnetic sources, an integral vectorial equation is derived for the accurate determination of currents on an antenna consisting of a waveguide of any shape, bearing a line of sources. This method is applied to any thick axisymmetrical antenna supplied through a slot; then, the integral equation is of the scalar type. A numerical method is given for the case of the thick cylindrical antenna with flat or spherical ends. The advantage of this solution lies in the fact that it can be extended to very different propagation problems in stratified media with various boundary conditions. Author

N71-13708# Istituto Universitario Navale, Naples (Italy).

ON THE INFLUENCE OF THE THICKNESS OF EXCITATION GAP ON ANTENNA PERFORMANCE

G. Franceschetti *In* AGARD Electromagnetics of the Sea Nov. 1970 10 p refs (See N71-13701 04-23)

Avail: NTIS

The input admittance and the effective height of a spherical antenna in a lossless or conducting environment is computed. The

antenna is assumed to be excited by means of a voltage applied to a small equatorial gap. The explicit dependence of the antenna's parameters on the excitation gap thickness is found and discussed. Analytical expressions and graphs of the above parameters are shown. It is found that an approach in the zero frequency limit should be very useful for these studies. For the situation of both antennas, or of one of them, submerged or buried, the radio link equation is computed. The optimum frequency which maximizes the ratio between the received and the transmitted power is found. The influence of the excitation gap thickness on the radio link is demonstrated. Author

N71-13709# Centre d'Etudes Theoriques de la Detection et des Communications, Paris (France).

CALCULATION OF ABSORBING FIELD MEDIUM REFLECTED FROM A METALLIC SURFACE [CALCUL EN MILIEU ABSORBANT DE CHAMP REFLECHIE PAR UNE SURFACE METALLIQUE]

Maurice Bouix and L. T. Bach *In* AGARD Electromagnetics of the Sea Nov. 1970 8 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)

Avail: NTIS

It is planned to schematize the electromagnetic detection of an absorbing medium, from a pinpoint source, like a magnetic dipole, as a sender, and a pinpoint receiver of the same type, with its axis in the symmetry plane of the former, so as to receive a zero field in an undefined medium; the presence of an obstacle represented by an undefined conducting plane creates a zero field. This excessively simple diagram, which would correspond to an infinite power issuing from the sender is modified by the introduction of a non-absorbing medium surrounding the sender and limited by a sphere, which makes it possible to perform a complete calculation, likely to be extended to any other pinpoint source, or to any homogeneous and isotropic absorbing medium. Author

N71-13710# Kansas Univ., Lawrence.

SURFACE WAVE PROPAGATION FROM VLF ARRAYS IN POLAR SEAS

Albert W. Biggs *In* AGARD Electromagnetics of the Sea Nov. 1970 12 p refs

Avail: NTIS

This paper describes VLF surface wave propagation over open ocean, sea ice, and glacier ice path segments. These propagation path segments provide mixed path effects in the Arctic, where ice depths range from those in new sea ice to that of the Greenland ice cap. The ice layers introduce surface waves to complement mixed path propagation. Some of the parameters include frequency, ice depth, and distribution of brine pockets, ice spheroids, water content, density, and temperature in the ice. Antenna pattern distortion of a linear array of horizontal dipoles illustrates the dependence of the radiation field as well as propagation loss on these parameters. Extension of VLF results to higher frequencies is made for related phenomena. Author

N71-13711# Research Inst. of National Defence, Stockholm (Sweden).

SOME RESULTS IN CONNECTION WITH A SEARCH FOR MAXIMUM UNDERWATER LF/VLF COVERAGE

Rune Lindquist *In* AGARD Electromagnetics of the Sea Nov. 1970 14 p refs (See N71-13701 04-23)

Avail: NTIS

A reasonable simple method of determining the underwater coverage from a radiostation in the LF/VLF range is described. The sea water attenuation is computed from a map showing the distribution of salinity in the waters surrounding Sweden. The ground wave field strength as a function of frequency and distance has been computed by classical methods. Corrections have been added to take account of the influence of sky wave interference. The field strength required at sea level to permit reception at a certain depth has been determined by considering both thermal and atmospheric noise. The use of the method is demonstrated in a search for optimum choice of frequency for a station serving a specified area around Sweden. It is further shown how a fixed maximum antenna height will influence the results. Finally, discussed are some simple semi-graphical methods for determining the various reception depths in the whole area. Author

N71-13712# Technische Hochschule Munchen (West Germany). Elektrophysikalisches Inst.

HIGHLY SENSITIVE ANTENNA COIL AND BALL ANTENNA FOR ELF ATMOSPHERICS

H. L. Koenig *In* AGARD Electromagnetics of the Sea Nov. 1970 5 p refs (See N71-13701 04-23)

(Contract AF 61(052)-836)

Avail: NTIS

Construction of an antenna coil for the reception of extremely low frequency atmospherics is described. The scaling laws of such a coil were calculated and showed that the signal to noise ratio increases with the 3/2 power of the diameter for a given winding cross section. The construction of a vinyl coil form of 2 m diameter which is wound with 40,000 turns of #32 wire is described. The coil has an inductance of 6600 Hz, a natural resonance frequency of 74 Hz and a dc resistance of 120 k ohm. To avoid parasitic signals in the coil due to mechanical vibrations of the coil in the natural magnetic field of the earth, a shock mount to support the axle was developed. Calibrations and calculations showed that a sensitivity of 9 V per 1 A/m can be obtained. For the reception of the electric field component of ELF-signals a ball antenna was constructed. This is advantageous because, due to the long wave length of the signals, the antenna signal depends only on the capacitance between the antenna and free space. As a protection against bad weather conditions the outside conducting layer of the antenna is surrounded by an insulation material. In order to reduce the noise produced by ionized rain drops a distance of 5 cm between the outside insulation material and the conducting layer of the antenna itself was provided. Author

N71-13713# Taunus-Observatorium (West Germany).

ON SOME OBSERVATIONS OF RADIO NOISE IN THE VERY LOW FREQUENCY BAND MADE DURING AN ATLANTIC CROSSING [SUR QUELQUES OBSERVATIONS DU BRUIT RADIOELECTRIQUE DANS LA BANDE TBF FAITES AU COURS D'UNE CROISIERE DANS L'ATLANTIQUE]

G. Mattern *In* AGARD Electromagnetics of the Sea Nov. 1970 6 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)

Avail: NTIS

During a four week voyage between Hamburg and Guyaquill (Ecuador) atmospheric radio noise was recorded with a 500 Hz to 5 KHz bandpass receiver. Diurnal intensity variations recorded, and radio noise spectrum patterns give an overall idea of Africa and South America storms. The data collected also reveal that, below latitude 40 N, the other atmospheric noise components (whistler, hiss, dawn chorus, etc.) do not significantly contribute to the average noise intensity. Author

N71-13716# Institute for Telecommunication Sciences, Boulder, Colo.

SPECTRAL CHARACTERISTICS OF HF GROUND WAVE SIGNALS BACKSCATTERED FROM THE SEA

D. D. Crombie, J. M. Watts, and W. M. Beery *In* AGARD Electromagnetics of the Sea Nov. 1970 8 p refs (See N71-13701 04-23)

Avail: NTIS

The phenomenon of resonant backscattering of HF radio waves from the surface of the sea is now well known. It occurs because of coherent scattering from a spatial component of the

sea surface having a wavelength of half the radio wavelength and travelling radially towards or away from the radar. A characteristic feature of the backscattered signal is that the Doppler shift is very near the value which would be expected for signals backscattered from sea waves having the theoretical phase velocity for waves of resonant length. Closer examination of the spectra of backscattered signals shows, however, that there are systematic differences from the theoretical values, and that the shape of the spectra do not conform to simple theory. These points will be illustrated using spectra observed at frequencies between 1.7 and 12.37 MHz, and explanations for the differences discussed. In addition, evidence for spectral lines of order higher than unity and other nonlinear surface gravity wave behavior will be discussed. Author

N71-13717# Technische Hochschule Hannover (West Germany).
THE REFLECTIVITY OF THE SEA SURFACE AT RADAR FREQUENCIES
W. H. Schoenfeld *In* AGARD Electromagnetics of the Sea Nov. 1970 18 p refs (See N71-13701 04-23)
Avail: NTIS

Reflections from the rough surface of the sea generate clutter; this means a conglomeration of unwanted signals in radar receivers which may mask the signals from small targets. An attempt is made to describe and explain observed phenomena of clutter signals by abstract models and theories. The results of theories are compared with measurements. A summary of known attempts of suppression of clutter signals with references is given. For many applications the improvement of the signal-to-clutter ratio is not yet sufficient. Two special measuring instruments are described. Results of measurements and future plans of investigations are discussed. Author

N71-13718# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
THE INTERACTION OF HF/VHF RADIO WAVES WITH THE SEA SURFACE AND ITS IMPLICATIONS
Donald E. Barrick *In* AGARD Electromagnetics of the Sea Nov. 1970 27 p refs (See N71-13701 04-23)
Avail: NTIS

The interaction of HF and VHF radio waves with the sea is examined using a boundary perturbation analysis. The effect of ocean roughness on ground-wave propagation across the ocean is seen as an increase in the effective surface impedance. Quantitative estimates are made of the added loss due to sea state using the Phillips wind-wave spectrum. Scatter from the sea is shown to arise from the Bragg effect. Both the scattered signal intensity and spectrum are derived and examined. Finally, several bistatic radar configurations for measuring ocean-wave spectra are analyzed. These involve various combinations of ships, buoys, aircraft, satellites, and shore stations. The feasibility of two such systems is examined in some detail. Author

N71-13719# Naval Research Lab., Washington, D.C.
DOPPLER SPECTRA IN MICROWAVE SCATTERING FROM WIND WAVES
J. W. Wright and W. C. Keller *In* AGARD Electromagnetics of the Sea Nov. 1970 13 p refs (See N70-13701 04-23)
Avail: NTIS

Doppler spectra in microwave backscattering from wind waves have been measured at X-band (3.2 cm) and K-band (1.25 cm) in a laboratory wind wave tank. The scattering can be accounted for as low order Bragg scattering and the spectral bandwidth is proportional to Bragg wave number and to wind speed. Author

N71-13722# Naval Research Lab., Washington, D.C.
ELECTROMAGNETIC FIELD FLUCTUATIONS IN TRANSMISSION THROUGH THE SURFACE OF THE SEA
Lewis Wetzel *In* AGARD Electromagnetics of the Sea Nov. 1970 11 p refs (See N71-13701 04-23)
Avail: NTIS

Due to the high conductivity of seawater, propagation of electromagnetic (radio) waves across the air-seawater interface is of practical interest only at relatively low frequencies. At such frequencies the relationship between subaqueous signal wavelengths and the characteristic dimensions of the perturbed sea surface permit reasonable approximations in the electromagnetic boundary conditions, which lead to useful expressions for the rms amplitude and power spectrum of the underwater field fluctuations. These expressions contain the sea wave spectrum and are functions of the signal frequency and the depth and velocity of the observation point. For example, the fluctuation spectrum seen by a stationary observer is a filtered version of the sea wave spectrum, the transfer function resembling that of a low pass filter in which the cut-off frequency and roll-off rate are determined by the signal frequency and the depth of the observer. The approximations are shown to cover a significant regime of depths and sea states over the given range of signal frequencies. The theory is illustrated by examples based on current models of the sea wave spectrum. Author

N71-13869# Washington Univ., Seattle. Fisheries Research Inst.
A UNIVERSAL INTERFACE AMPLIFIER FOR COUPLING AN ECHO SOUNDER TO A MAGNETIC TAPE RECORDER
Edmund P. Nunnallé and James H. Green 15 Jun. 1970 11 p *Its* Fisheries Res. Inst. Circ. No. 70-7
(Grant NSF-GH-66)
(PB-192982; WSG-70-3) Avail: NTIS CSCL 08A

A universal interface amplifier was designed and constructed recently as part of the University of Washington's Marine Acoustics Program. The device converts the frequency and amplitude of the video output of an echo sounder, the signal that represents target information, to a frequency and amplitude that is acceptable to a standard stereophonic tape recorder. The unit was designed for ease of operation and utility. Only two external switch settings are required for its operation. The first switch selects the echo sounder output frequency that is to be converted and recorded on magnetic tape. The second switch selects input attenuation so that an acceptable output voltage level for the tape recording system is obtained. Author (USGRDR)

N71-13880*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.
A STUDY OF DIGITAL TECHNIQUES FOR SIGNAL PROCESSING Final Status Report, 1 Aug. 1969–31 Jan. 1970
Mischa Schwartz and Robert R. Boorstyn 31 Jan. 1970 14 p refs
(Grant NGR-33-008-040)
(NASA-CR-115815) Avail: NTIS CSCL 17B

Research in adaptive signal processing is reported with the major efforts directed towards the establishment of adaptive equalizers for digital transmission and Markov processes for nonlinear detection and estimation. A new method for the adaptive equalization of signals transmitted through dispersive channels was analyzed and involved two types of algorithms: a first order one in which the distortion, although minimized at the end of M intervals, may increase at intermediate intervals, and a second order one in which the distortion decreases monotonically at each iteration. Emphasis was placed on investigating the second order scheme, considering its performance in noise, verifying its operation through computer simulation, and analyzing the performance of sub-optimum second order schemes using constant coefficient algorithms. D.L.G.

N71-13901# Advisory Group for Aerospace Research and Development, Paris (France).
ADVANCED RADAR SYSTEMS
Roger Voles, ed. Nov. 1970 523 p refs Presented at the 19th

Meeting of the Avionics Panel of AGARD, Istanbul, 25-29 May 1970
(AGARD-CP-66) Avail: NTIS

Advanced radar systems considered emphasize digital techniques and components for signal detection in the presence of clutter. Target acquisition, microwave subsystems, digital signal and data processing, and special systems are discussed. For individual titles, see N71-13902 through N71-13939.

N71-13902# Naval Research Lab., Washington, D.C.
RADAR SEA RETURN IN HIGH WIND/WAVE CONDITIONS
Norman W. Guinard and John T. Ransone, Jr. *In* AGARD Advanced Radar Systems Nov. 1970 15 p refs (See N71-13901 04-07)
Avail: NTIS

Developed is a new model for the radar cross section of the sea which is based on the scattering from a composite surface. The model predicts an upper bound (saturation value) for the radar cross section and also yields expressions for its variation with frequency, polarization and grazing angle. To verify the predictions of the model under extreme conditions, an extensive measurement program was conducted over the North Atlantic in February 1969 using a four-frequency radar system installed in an EC-121 aircraft. Data were acquired in sea states with winds which varied from Beaufort 0 to 8 with a maximum observed sea state condition of a 48-knot wind. The results of the measurement have verified the existence of the saturation condition for wind speeds above 10 knots as well as the variation of the radar cross section with frequency, polarization and grazing angle with proviso that the tilting of the scattering surface by the swell be accounted for in the interpretation. Author

N71-13903# Royal Radar Establishment, Malvern, (England).
AN EXPERIMENTAL STUDY OF SOME CLUTTER CHARACTERISTICS
M. P. Warden *In* AGARD Advanced Radar Systems Nov. 1970 18 p refs (See N71-13901 04-07)
Copyright. Avail: NTIS

Results based on a statistical analysis of clutter echoes using a 10 cm surveillance radar are reported. Probability distributions of clutter radar cross-sections have been computed for ground, precipitation and bird angels and changes in the distributions for different pulse lengths and polarizations and as a function of time are reported. Ground clutter cross-section distributions of signals obtained over an arc at constant range and over a defined area show a log normal character with a standard deviation of about 25 dB. Over a period of several months the standard deviation remains unchanged while the mean value fluctuates by plus or minus 2.5 dB. A 10:1 change in pulse length produces an 18 dB shift in the distribution. Measurements on rain support the theory based on an assembly of a large number of independent scatterers contained in the resolution cell. Using circular polarization cancellation figures of 21 dB have been measured. A possible ground clutter model has been suggested and its predictions give a good fit to experimental results. Author

N71-13904# SHAPE Air Defense Technical Center, The Hague (Netherlands).
METHODS AND INSTRUMENTATION FOR ASSESSMENT OF THE SPECTRAL PROPERTIES OF RADAR CLUTTER
T. Kester and J. Einbu *In* AGARD Advanced Radar Systems Nov. 1970 16 p refs (See N71-13901 04-07)
Avail: NTIS

A knowledge of the frequency spectra of radar clutter is essential for the design of new radar systems and the assessment of the performance of existing Moving Target Indicators (MTI). Considered are the theoretical prediction of the spectral parameters of rain clouds and the instrumentation for measurement of clutter spectra. A new model for calculation of the mean Doppler speed and the standard deviation of the velocity spectrum of rain cloud is described. These values are computed as a function of different parameters using numerous measured wind profiles. Their statistical evaluation is followed by a comparison of our model with the linear wind shear model. Equipment for the measurement of the fine structure of radar Doppler spectra is described. Some spectra, obtained with the help of a fast fourier transform and sample weighting, are shown as well. Author

N71-13905# Army Electronics Command, Fort Monmouth, N.J.
SOME MEASUREMENTS OF RADAR ANGELS (FALSE RADAR TARGETS)
W. Fishbein, E. Frost, and W. E. Vander Meer *In* AGARD Advanced Radar Systems Nov. 1970 10 p refs (See N71-13901 04-07)
Avail: NTIS

There have been many reports of unexplained targets on radar displays. These targets have been given a variety of names, radar angels, dot angels, and clear air echoes, to name a few. The density of radar angel echoes can often be high enough to cause serious interference to radar operation. An investigation was conducted to determine some of the detailed characteristics of these echoes. The investigation consisted of observation and analysis of angel echoes detected on the B display of a 16 gigahertz (GHz) radar and gathering of doppler frequency signatures with a 10 GHz coherent radar. The results of the investigation show that nearly all the angels observed were radar reflections from birds and insects. These results are consistent with observations of other investigators. The conclusion drawn from the investigation is that in the design of a sensitive radar, the problem of sky clutter caused by birds and insects must be considered. Due to its doppler frequency characteristics, sky clutter presents a more difficult discrimination problem than conventional ground clutter. Author

N71-13906# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
CHARACTERISTICS OF ECHOES FROM AIRCRAFT AND CLUTTER DERIVED FROM DIGITAL RECORDED RADAR DATA
Karl von Schlachta *In* AGARD Advanced Radar Systems Nov. 1970 21 p refs (See N71-13901 04-07)
Avail: NTIS

The coherent echo signal from different surveillance radars was digitized and stored on magnetic tape with a special recording device. Evaluation with a computer gives knowledge about the statistical behavior of different targets and various kinds of clutter. Echoes from several types of aircraft were recorded. The evaluation gives results about the amplitude and phase shift of the echo signal measured during one scan, and about the fluctuation of the echovector during the flight. The evaluation of clutter data gives a survey about the distribution of the power spectral density for several kinds of clutter as ground clutter, weather clutter, phantom clutter and bird echoes. It follows, that the methods of clutter suppression depend on the kind of the clutter and have to be different for fixed clutter and moving clutter. Author

N71-13907# Admiralty Surface Weapons Establishment, Portsmouth (England).
SOME MEASUREMENTS OF THE EFFECTS OF FREQUENCY AGILITY ON AIRCRAFT RADAR RETURNS
W. S. Whitlock, A. M. Shepherd, and A. L. C. Quigley *In* AGARD Advanced Radar Systems Nov. 1970 13 p refs (See N71-13901 04-07)
Avail: NTIS

A C-band radar with pulse-to-pulse frequency agility is used to investigate the effects of frequency change on aircraft echo amplitude and scanned echo patterns. Decorrelation effects of

pulse-to-pulse frequency changes from zero to 190 MHz have been measured using Sea Hawk and Comet aircraft. The aircraft's radar cross-section changed as much as 20 dB for a frequency change of 20 MHz. The frequency cross-correlation coefficient is zero for a frequency change of 20 MHz and is negative for larger changes. No significant difference between the frequency correlation coefficient was found for the two aircraft studied. Some effects of frequency agility on scanned echo patterns and echo fading are presented. Author

N71-13908# Technology Service Corp., Santa Monica, Calif.
RECENT DEVELOPMENTS IN TARGET MODELS FOR RADAR DETECTION ANALYSIS
P. Swerling *In* AGARD Advanced Radar Systems Nov. 1970 22 p refs (See N71-13901 04-07)
Avail: NTIS

Reviewed are target signature models, including fluctuations whose statistical behavior is governed by chi-square, log-normal and Rice distributions; briefly described are possible physical characteristics of targets which tend to give rise to these distributions and detection probability results for these families. Partially correlated cases are included. Several methods are given whereby published detection probability curves can be interpolated or extrapolated in a simple manner to partially correlated cases as well as to other probability distributions. Most of the results discussed assume conventional radar receiver models. However, a brief discussion is given of the consequences of various target models for more intricate types of receiver processing such as Constant False Alarm Rate (CFAR) methods, frequency diversity methods, and high resolution (short pulse) methods. Author

N71-13909# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE THEORY OF AMPLITUDE COMPARISON MONOPULSE RADAR IN A CLUTTERED ENVIRONMENT
E. M. Hofstetter *In* AGARD Advanced Radar Systems Nov. 1970 15 p refs (See N71-13901 04-07)
Avail: NTIS

Considered is the problem of detecting and estimating the unknown angular location of a target that is observed simultaneously by a number of antenna beams. The amplitude of the signal received by a particular antenna is assumed to depend on the angular location of the target, but the time of arrival of the signal is assumed to be the same at all of the antennas. The received signals are assumed to be corrupted by a combination of receiver front-end noise and clutter. The covariance matrix of the clutter signal appearing on the various beams either may be assumed known from previous measurements or else assumed to be an unknown parameter that must be estimated along with the angular coordinates of the target. In the latter case, multiple coherent or incoherent observations of the target-clutter complex must be available for processing at the receiver. The generalized likelihood ratio test is used to derive the detection and parameter estimation strategy for the radar receiver. Expressions for the detector and the angle estimates are derived in a number of important cases and used to demonstrate several interesting properties of the likelihood ratio receivers. Finally, the case where the beams are conventional sum and difference beams is considered. An approximation to the likelihood receiver is derived for this case and shown to have a much more easily realizable structure than the exact likelihood receiver. Author

N71-13910# Selenia S. P. A., Rome (Italy).
TRACKING ERRORS IN A FREQUENCY AGILITY SYSTEM
P. F. Guerguaglini *In* AGARD Advanced Radar Systems Nov. 1970 12 p refs (See N71-13901 04-07)
Avail: NTIS

The influence of frequency agility on tracking errors in a radar system is evaluated. The use of frequency agility modifies the received spectrum. Therefore the magnitude of the glint and scintillating errors changes. In order to find the signal spectrum, the correlation between succeding pulses has been evaluated. The correlation is dependent on frequency agility bandwidth, on target dimensions and on the law by which the transmitted frequency is chosen. Transforming the signal autocorrelation function, the received power spectrum has been obtained; a broadening of the spectrum due to the reduction of the correlation among pulses, occurs. Expressions of glint and scintillation errors have been obtained. For some specific cases errors have been evaluated and plotted as a function of the correlation coefficient. From the analysis of the results, it is possible to draw this conclusion: the use of frequency agility gives a reduction of tracking errors for a monopulse radar. For a conical-scan system, while the glint error is always reduced, the scintillation error may increase. Author

N71-13911# Technology Service Corp., Santa Monica, Calif.
COHERENT AND NONCOHERENT BANDWIDTH IN RADAR RESOLUTION
August W. Rihaczek *In* AGARD Advanced Radar Systems Nov. 1970 12 p refs (See N71-13901 04-07)
Avail: NTIS

Coherently used signal bandwidth permits the energy concentration in time that is the basis for much of the resolution potential of radar. There still remain problems such as target fluctuations or delays not representative of target range. Noncoherent use of bandwidth, be it in the form of single-pulse or pulse-to-pulse frequency diversity, does not improve nominal resolution. However, it smoothes the fluctuations of clutter, for improved detection performance, or the variations in target cross sections or cross-section distributions. This paper investigates the significance of coherent and noncoherent bandwidth for high-performance radar. The utility of the two methods of bandwidths used is considered for such representative tasks as the measurements of target cross sections and high-resolution range profiles, signature analysis, target detection in clutter, and resolution based on the synthetic aperture approach. The principles are illustrated by several examples of the processing of simulated target returns. Author

N71-13913# Compagnie Generale de Telegraphie sans Fil, Paris (France.)
OPTIMIZATION BY COMPUTER OF AIRPORT RADOMES [OPTIMISATION SUR ORDINATEUR DES RADOMES AEROPORTES]
R. Pierrot *In* AGARD Advanced Radar Systems Nov. 1970 9 p ref In FRENCH (See N71-13901 04-07)
Avail: NTIS

The described computer program calculates antenna beam projection from radomes. Evaluations of axial deviation, transmission fading and remounting of secondary sidelobes are used to obtain optimal parametric combinations for considered problems (general radome form, permissible wall thickness), the theoretic radio electrical performance, and the importance of perturbation effects on radome realization and of temperature variations during flight. Transl. by G.G.

N71-13914# Compagnie Generale de Telegraphie sans Fil, Paris (France).
PATTERN COMPRESSION BY SPACE-TIME BINARY CODING OF AN ARRAY ANTENNA
S. Drabowitch and C. Aubry *In* AGARD Advanced Radar Systems Nov. 1970 10 p refs (See N71-13901 04-07)
Avail: NTIS

Described is a process of space scanning by means of an array antenna, the radiation pattern of which is time-modulated. This modulation is obtained by associating a 1 bit phase-shifter to each radiating element of the array. The received signals are processed by means of adaptive filters or of correlators corresponding to various direction samples. Three coding types are considered:

reception coding, transmission-reception coding and periodic coding. The main advantages of the space-time binary coding results from the simplicity and economy of the phase-shifters and their control elements. These advantages are obtained at the expense of an energy loss of at least 3 dB. Author

N71-13915# Ministry of Technology, London (England).
FLOOD-LIGHTING WITH NYQUIST RATE SCANNING
A. K. Edgar and I. L. Jones *In* AGARD Advanced Radar Systems Nov. 1970 11 p (See N71-13901 04-07)
Copyright. Avail: NTIS

The principles of flood-lighting with Nyquist rate scanning as applied to radar systems are given, followed by a description of a practical embodiment covering an experimental 10 cm. radar. The experimental radar uses a 63 element receiver array, scanning at the Nyquist rate (100 kHz) and a klystron transmitter of 200 watts mean power. The system is designed to scan over 90 deg in azimuth. An outline is given of the main features of the equipment, together with a discussion of experimental results. It is shown that theoretical predictions on efficiency are borne out, and that in particular, very good M.T.I. performance is possible. Author

N71-13916# Radio Corp. of America, Moorestown, N.J.
PHASED ARRAY RADARS FOR AEROSPACE APPLICATIONS
Arthur S. Robinson *In* AGARD Advanced Radar Systems Nov. 1970 13 p (See N71-13901 04-07)
Avail: NTIS

Phased array radars have been contenders for aerospace applications for many years. Until recently, the conversion of this potential into competitive equipment designs has been severely limited by technology and cost considerations. A number of major trends have now emerged that point the way to highly competitive aerospace phased array radar designs. This paper highlights these trends by exploring the relative roles of operational requirements, system designs, science, and technology, in achieving cost-effective phased array radar designs. Author

N71-13917# Siemens A.G., Munich (West Germany).
THE LINEAR ARRAY FOR BEAM STEERING
R. Reitzig *In* AGARD Advanced Radar Systems Nov. 1970 7 p (See N71-13901 04-07)
Avail: NTIS

The radiation performance of a phased 8-dipole array with uniform and Dolph-Tchebycheff excitation and a 16-dipole array with a consine aperture distribution is theoretically studied on models which exclude the element coupling. The computed results are then compared with measurements thus giving some information on the deteriorating effects of mutual coupling. The influence of systematic phase-errors as they are usually obtained by digitally approximating a linear phase progression along the array aperture is also considered. Author

N71-13918# Radio Corp. of America, Princeton, N.J.
MICROWAVE SOLID STATE POWER SOURCES FOR AIRBORNE PHASED ARRAYS
Fred Sterzer *In* AGARD Advanced Radar Systems Nov. 1970 5 p (See N71-13901 04-07)
Avail: NTIS

Several cw solid-state power modules for airborne phased array applications are described: (1) hybrid integrated L-band modules using transistor amplifiers (2) hybrid integrated S-band modules using transistor amplifiers followed by varactor doublers; (3) coaxial C-band modules using circulator-coupled negative resistance transferred electron amplifiers; and (4) coaxial X-band modules using circulator coupled negative resistance transferred electron and Impatt amplifiers max. Author

N71-13919# Sedco Systems, Inc., Farmingdale, N.Y.
LIGHTWEIGHT PHASED ARRAY SYSTEMS FOR AIRBORNE AND GROUND BASED APPLICATIONS
M. Simpson *In* AGARD Advanced Radar Systems Nov. 1970 14 p (See N71-13901 04-07)
Avail: NTIS

Design and performance capabilities of several different types of lightweight phased array antenna systems which may have application in a number of areas such as forward area battlefield surveillance radar, air traffic control radar, lightweight mortar locator systems, airborne weather, terrain clearance and terrain avoidance radars, among others are discussed. The systems fall within the microwave frequency band of 1 to 18 GHz. Specific design and component selection parameters are discussed for linearly scanned phased array antenna systems optimized for operation in various portions of the overall frequency band. Antenna models in the S and X frequency bands were fabricated and tested. Results indicated very close correlation with theoretical predictions and were in accordance with specification requirements. A discussion is presented of the critical components used in these antenna systems such as phase shifters and antenna feed systems. The allowable errors for these critical components are analyzed. It is shown that error tolerances are considerably more severe than those which may be accepted on large phased array systems. It is also shown that antenna performance for small phased arrays can be substantially superior to that obtained with conventional dish type mechanical antenna systems. A description is given of the electronic beam control and processing system used with these antennas in order to provide scan and track capability. Author

N71-13920# Compagnie Generale de Telegraphie sans Fil, Paris (France). Div. Radar De Surface.
TRACKING RADAR WITH HIGH RANGE RESOLUTION [RADAR DE POURSUITE A GRAND POUVOIR SEPARATEUR EN DISTANCE]
Henri G. P. Forestier and Michel Chevalier *In* AGARD Advanced Radar Systems Nov. 1970 15 p In FRENCH (See N71-13901 04-07)
Avail: NTIS

A radar has to emit a very large frequency spectrum in order to obtain high range resolution. Bandwidth compression, notwithstanding correlative expansion of the time scale, is very desirable to pull in usable scattered signals. Such a method is applicable to a tracking radar whose working signal does not include the weak part of the radar return. By applying at one and the same time correlation techniques and impulse compression, a tracking radar of high range resolution is developed that possesses a spectrum of several tens of MHz and permits high resolution at several meter distance suitable for radar video frequency circuits. Transl. by G.G.

N71-13923# Elliott-Automation Radar Systems, Ltd., Boreham Wood (England).
SWITCHED CAPACITOR STORAGE ARRAYS FOR AMTI AND BANDWIDTH COMPRESSION
D. S. Harris *In* AGARD Advanced Radar Systems Nov. 1970 7 p (See N71-13901 04-07)
Avail: NTIS

In non-coherent moving target indicator systems, fully coherent moving target indicator systems and clutter locked Stalo-Coho systems, moving targets cause amplitude modulation of either clutter or a reference signal at the detected receiver output. This amplitude modulation is usually separated from the clutter either by bandpass filtering or by subtraction of successive returns in the amplitude-time plane. A sampled range gate canceller system is described that uses two sets of capacitors in place of the conventional delay line. Each outgoing transmitter pulse is used to start a precision range clock which is stopped after the maximum range delay has elapsed. This range clock operates a number of

video sampling switches to connect each sample of a radar signal in turn to a different capacitor in the store. On successive returns, the storage capacitors are reversed relative to the flow of video current, thus performing subtraction. Being asynchronous, the system has the advantage of being insensitive to pulse-to-pulse jitter. The read-out of subtracted differences can be performed at any time after the delay and before the next transmitted pulse. Each read-out sequence is followed by an erase sequence to prepare the capacitance store for the next period of radar returns.
Author

N71-13925# Admiralty Surface Weapons Establishment, Portsmouth. (England).
A DIGITAL MTI CANCELLER
A. Reiss *In* AGARD Advanced Radar Systems Nov. 1970 9 p (See N71-13901 04-07)
Avail: NTIS

Some practical aspects of an experimental digital moving target indicator canceller are described with particular emphasis on circuits and components for the principal functions of sampling, analogue/digital conversion, the digital canceller which comprises MOST shift register storage and binary substraction, the combining of in-phase and quadrature channels and, finally, the digital/analogue conversion to obtain video signals for displays. P.R.F. flexibility, off-the-shelf integrated circuits, small volume and low power consumption are some of the advantages in digital canceller systems. The experimental system in early 1969 was the first model to be deomonstrated in the U.K. Features of this model are: 120 range quanta, choice of 1, 2 and 4 microsecond quantum period, and twin channel, double cancellation. A second model with a larger store is nearing completion.
Author

N71-13926# Plessey Radar, Ltd., Cowes (England).
THE PLESSEY DIGITAL MTI SYSTEM
P. Bradsell *In* AGARD Advanced Radar Systems Nov. 1970 10 p (See N71-13901 04-07)
Avail: NTIS

The Plessey Digital moving target system was designed from the start as part of an air traffic control radar system. The cabinet contains the coherent receivers and digitizer, the canceller frame, the digivideo (signal processing) frame and all clock and timing circuits. It takes in interference signals and lock pulse and normal video from the transmitter receivers and gives out video to the displays. The transmitter is triggered from the moving target indicator rack either at internally generated pulse rate frequency or in synchronism with an external lock pulse. The system was completely developed in one year and is now in production.
Author

N71-13927# Compagnie Generale de Telegraphie sans Fil, Paris (France). Div. Radar de Surface.
DIGITAL METHOD FOR MONOPULSE SIGNAL ANALYSIS IN THE PRESENCE OF CLUTTER [METHODE DE TRAITEMENT DIGITAL DE SIGNAUX MONOPULSE EN PRESENCE DE CLUTTER]
Henri G. P. Forestier and Michel Gaudron *In* AGARD Advanced Radar Systems Nov. 1970 9 p ref In FRENCH (See N71-13901 04-07)
Avail: NTIS

The described digital technique for monopulse radar signals in clutter environment codes the signal of each channel by: (1) an amplitude in the multifrequency receiver using dynamic floating point representation: and (2) a phase analogy for processing multiple target indicator output in phase code at 360 degrees. Elimination of fixed echoes and clutter per triangular resolution is performed analog by multiple target indicator linearization through single and double cancellations. The treated signal of each monopulse channel is finally used to calculate angular direction and altitude of the moving target.
Transl. by G.G.

N71-13928# Compagnie Generale de Telegraphie sans Fil, Paris (France).
ANALYTIC SYSTEM USING A COHERENT RADAR FOR MEASURING THE DISTANCE AND RADIAL VELOCITY OF RADAR TARGETS [SYSTEME DE TRAITEMENT ASSOCIE A UN RADAR COHERENT POUR MESURER LA DISTANCE ET LA VITESSE RADIALE DES CIBLES]
J. Sirven *In* AGARD Advanced Radar Systems Nov. 1970 10 p In FRENCH (See N71-13901 04-07)
Avail: NTIS

Coherent pulse radar at low frequency eliminates echo clutter in weak Doppler frequencies and provides usable target range but, in general, target speed does not show ambiguity. The described system uses a coherent emitter that modulates emission wave by two periodic pulse trains separated by a very short time interval during repeat. Linear reception analysis allows echo clutter suppression by using two synchronized detectors for phase information storage at the end of filtration. Distance ambiguity is introduced by amplyfiying amplifying the emission wave through logical operation while the level of the speed is obtained through phase shifts of the two impulse trains as they reflect from the target.
Transl. by G.G.

N71-13929# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
DETECTION OF DOPPLER SHIFTED RADAR SIGNALS WITH CLUTTER REJECTION
W. D. Wirth *In* AGARD Advanced Radar Systems Nov. 1970 20 p refs (See N71-13901 04-07)
Avail: NTIS

The problem of detecting Doppler shifted radar signals in clutter and noise is treated with the likelihood-ratio test. For the application of this test, which is optimal with respect to the error probabilities, informations about targets and clutter are necessary. A seperate measurement and data evaluation program resulted in sufficient knowledge about target and clutter signals to construct the test function. The detection system consists of a set of weighting functions, which form a filter bank to cover the whole Doppler range. All individual weight functions perform two tasks: detection of their respective Doppler signal, if present, and suppression of the clutter signals. An experimental system combines digital and analog techniques. If the spectrum of the clutter is varying with time, the filter may be divided into an adaptive clutter suppression filter and a doppler filter bank. The weighting function for clutter suppression in this case has to be derived from real time estimates of the clutter correlation.
Author

N71-13930# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIGITAL SIGNAL PROCESSING FOR RANGE-GATED PULSE DOPPLER RADARS
B. Gold and C. E. Muehe *In* AGARD Advanced Radar Systems Nov. 1970 10 p refs (See N71-13901 04-07)
Avail: NTIS

For many applications, digital signal processing can increase the effectivenes of range-gated pulse doppler radars. When many doppler filters are desired for each ran gate, the fast Fourier transform algorithm is more efficient than digital filtering. In this paper, digital processing methods are briefly reviewed and the signal processing requirements are established in terms of the radar parameters. Equivalence relations are established between the fast Fourier transforms and a bank of velocity filters. Finally, the structure of a general purpose radar digital signal processor is described which should be applicable to a variety of range-gated pulse doppler systems.
Author

N71-13931# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
DATA PROCESSING CONSIDERATIONS IN ADVANCED

PHASED ARRAY RADAR SYSTEMS

G. Cokas and J. H. Parsons *In* AGARD Advanced Radar Systems Nov. 1970 10 p refs (See N71-13901 04-07)

Avail: NTIS

Presented is a broad overview of data processing considerations for advanced phased array radars. Data representing radar processing experience have been collected from a number of organizations engaged in radar design and computer programming. These data have been correlated with industrial experience obtained from other data processing applications. The necessary growth of radar data processing is traced together with the consequences of this growth. Examples of particular solutions to data processing problems are cited to demonstrate how technology has changed. Residual problems are evaluated and some possible solutions are discussed. Author

N71-13932# SHAPE Air Defense Technical Center, The Hague (Netherlands). Systems Research Div.

OPERATIONAL EMPLOYMENT AND DETECTION PERFORMANCE OF ADVANCED COMPUTER-CONTROLLED RADAR SYSTEMS

J. A. Bijvoet *In* AGARD Advanced Radar Systems Nov. 1970 17 p refs (See N71-13901 04-07)

Avail: NTIS

Studied is the suitable operational control of full or partial electronically-steered radars. Horizon and grazing search modes are discussed which provide the minimum search time, which leave the least possible freedom for target concealment in clutter and which provide a maximum of time left for use of anti-clutter measures during sub-horizon searching. Design curves are presented relating the number of obtainable beam positions, in non-adaptive volume search modes, to required transmitter peak power and numbers of hits on target. Design curves are presented relating volume search time to system range and required volume coverage, and taking into account pulse repetition rate adaptation to beam elevation, off-broadside beam widening and adaptation of the number of hits to beam elevation for providing a constant volumetric detection probability. A constant spatial detection probability, optimum use of the time and power, and a constant tangential target location accuracy can be achieved by the use of an inversely-proportional antenna, of which both the azimuth and elevation beamwidths are inversely proportional to range. The importance of the use of very narrow beams is stressed, for reasons for reducing gorund illumination, improving performance against clutter, and improving target tracking performance. Author

N71-13933# Plessey Co., Ltd., Addelstone (England).

DIGITAL PLOT EXTRACTION OF PRIMARY RADAR

N. H. A. Smith and I. R. Jackson *In* AGARD Advanced Radar Systems Nov. 1970 8 p (See N71-13901 04-07)

Avail: NTIS

The digitization or plot extraction of primary radar data which can be used to fulfill two purposes: (1) to permit narrow band transmission of radar data from a remote radar site to a center at which displays are located; and (2) to provide a bright display of primary radar data using conventional fluoride displays without involving scan conversion. Covered are techniques involved in both hit detection and plot detection of aircraft echoes derived from a primary radar together with the various techniques employed to reduce the incidence of false plots due to clutter and weather. Reference to secondary radar plot extraction is made and the system requirements for processing and displaying plot extracted radar data is discussed. Author

N71-13934# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).

DESCRIPTION OF A TRACKING STRATEGY FOR PHASED ARRAY RADAR

G. Van Keuk *In* AGARD Advanced Radar Systems Nov. 1970 11 p refs (See N71-13901 04-07)

Avail: NTIS

A strategy for simultaneous tracking of many targets by a phased-array-radar system is described. The accuracy of each track is defined by a limiting volume, so that the probability of the target to lie outside vanishes exactly. Errors in location and limiting values for the cinematical behaviour of the targets are taken into account. The expectation value of the total costs for tracking a fixed number of equidistributed objects of one kind is calculated. It depends strongly on the accuracy of the track and the number of stored echoes. Because no smoothing methods are used, the density of the distance between the target and the center of the expectation volume is easily calculated. There is a simple relationship between the implied cinematics and the tracking costs, so that the advantage of adaption during the tracking of a target can be derived approximately. Author

N71-13935# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).

SOME STATISTICAL RESULTS COMPARING DIFFERENT TRACKING LOGICS

W. A. Both and H. Fleckner *In* AGARD Advanced Radar Systems Nov. 1970 15 p refs (See N71-13901 04-07)

Avail: NTIS

The idea of a radar-digital extractor-computer controlled air space resulted until now in a variety of track operators, which all have the common objective to approximate the real air traffic situation by an adequate track net. In the sequel two sensible functions are given which in a certain sense measure the quality of a track-operator's approximation of a real net. Futhermore, some knowledge about real- and false track processes concerning a special track operator is gained. As an example the functions are applied to some track operators based on primary radar information. Author

N71-13936# Aeg-Telefunken, Ulm (West Germany).

DIGITAL RADAR PLOT EXTRACTOR: A SYSTEM MODULE OF AN AUTOMATIC AIR TRAFFIC CONTROL SYSTEM

H. Ebert and U. Siegenthaler *In* AGARD Advanced Radar Systems Nov. 1970 17 p (See N71-13901 04-07)

Avail: NTIS

Described are the computer system's functions in target tracking and presentation of processed data. Tracking, i.e. automatic recognition of aircraft movements, is done in a first digital computer based on the transmitted information of several radar installations whose coverage areas overlap (multiradar tracking). A second computer is used for processing the information that is presented at the individual controller displays. The radar plot extractor consists of two parts, the plot detector and the plot processing unit. The plot detector is a system specifically designed for automatic target recognition and determination of target coordinates. For further processing of target information again a digital computer is used. Author

N71-13937# Christiaan Huygenslaboratory, Noordwijk (Netherlands).

RUDAR: AN EXPERIMENTAL NOISE RADAR SYSTEM

J. A. Smit *In* AGARD Advanced Radar Systems Nov. 1970 18 p refs (See N71-13901 04-07)

Avail: NTIS

The results of experiments with a noise radar, performed in 1964, are given. Attention has been focussed on a flexible cross-section of a possible complete system. As a consequence the system performance with relatively simple hardware is analysed. Several features of the system have been shown, viz.: the antenna system can be used as a space filter, and there is an option for azimuth measurement by mechanical- or frequency scanning. Advantages and disadvantages of such a system are discussed. Author

N71-13938# Electronique Marcel Dassault, St. Cloud (France).
HELICOPTER RADAR FOR OBSTACLE AVOIDANCE [RADAR D'EVITEMENT D'OBSTACLES POUR HELOCOPTERE]
Gerard Collot *In* AGARD Advanced Radar Systems Nov. 1970 16 p In FRENCH (See N71-13901 04-07)
Avail: NTIS

The described radar is mounted on the helicopter nose and its operation permits helicopter flight during all seasons at very low altitudes. The equipment consist mainly of the radar unit that scans during overflight the surrounding space and an indicator installed in the cockpit on whose surface images all obstacles. The radar adapts particular well to helicopter flight conditions and its reflections make it possible to avoid vertical as well as horizontal obstacles. Obtained flight test results employing natural as well as artificial obstacles, such as towers and high power cables, confirmed theoretical evaluations. Transl. by G.G.

N71-14427*# Time, Inc., New York.
POSSIBLE AREAS OF CONTROL THEORY IN PRINT COMMUNICATION
John L. Hallenbeck *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 3–13 (See N71-14426 04-34)
Avail: NTIS CSCL 09D

Control theory applications are inferred as the status of Time Incorporated in the communications industry is discussed in terms of journalism, product manufacturing, sale and delivery of the product, sale of advertising space, and collateral activities. Examples of technology innovations in pre-press and post-press magazine publishing operations are cited and suggestions for further applications of control theory in the communications industry are presented. E.C.

N71-14428*# Massachusetts Inst. of Tech., Cambridge.
DISCUSSION OF HALLENBECK PAPER
Henry M. Paynter *In* NASA. Electron. Res. Center Future Fields of Control. Appl. Aug. 1969 p 15–22 (See N71-14426 04-34)
Avail: NTIS CSCL 09D

Technology trends in the mass production of printed communications are considered. Observations are made on: home video display of periodicals, timeliness in printed information dissemination and reception, systems obsolescence due to incremental technology exploitation, industrial collaboration as opposed to competition, and information selectivity among news media publishers and their readers. E.C.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N71-13490# Stanford Univ., Calif. Dept. of Computer Science.
SEMANTICS OF ALGOL-LIKE STATEMENTS
Shigeru Igarashi Jun. 1970 101 p refs
(Contract ARPA SD-183)
(AD-712460; CS-167; AIM-129) Avail: NTIS CSCL 9/2

The semantics of elementary Algol-like statements is discussed, mainly based on an axiomatic method. Firstly, a class of Algol-like statements is introduced by generalized inductive definition, and the interpretation of the statements belonging to it is defined in the form of a function over this class, using the induction principle induced by the above definition. Then a category of program is introduced in order to clarify the concept of equivalence of statements, which becomes a special case of isomorphism in that category. A revised formal system representing the concept of equivalence of Algol-like statements is presented, followed by elementary metatheorems. Finally, a process of decomposition of Algol-like statements, which can be regarded as a conceptual compiler, or a constructive description of semantics based on primitive actions, is defined and its correctness is proved formally, by the help of the induced induction principle. Author (TAB)

N71-13491# Academy of Sciences (USSR), Leningrad. Scientific Council on the Complex Problems of Cybernetics.
FOURTH SYMPOSIUM ON THE PROBLEM OF REDUNDANCY IN INFORMATION SYSTEMS, PART 1
1970 383 p refs In RUSSIAN Conf. held at Leningrad
Avail: NTIS

Eighty-three papers (43 in volume 1, 40 in volume 2) are presented covering redundancy aspects of coding and decoding, component reliability, transmission efficiency, control systems, information systems, data transmission, error and signal analyses, and error correction. Transl. by E.C.

N71-13492# Academy of Sciences (USSR), Leningrad. Scientific Council on the Complex Problems of Cybernetics.
FOURTH SYMPOSIUM ON THE PROBLEM OF REDUNDANCY IN INFORMATION SYSTEMS, PART 2
1970 354 p refs In RUSSIAN Conf. held at Leningrad
Avail: NTIS

For abstract, see N71-13491.

N71-13493# California Univ., Los Angeles. Management Science Inst.
APPLYING A NEW METHODOLOGICAL APPROACH TO A PROBLEM OF INFORMATION PROCESSING MODEL VALIDATION
James R. Bettman Oct. 1969 47 p refs Sponsored in part by NSF and ONR *Its* Working Paper No. 152
Avail: NTIS CSCL 09B

The notion of the characteristic function of a binary decision graph as a tool for analyzing the validation of complex information processing models is introduced. The technique sheds light on the specific validation question: how one can discern which of a set of process models with similar output is more relevant with regard to the particular set of decision subprocesses it contains. The approach is illustrated by applying the characteristic function to information processing models of consumer decision processes. After a brief description of these models, the characteristic function is defined and the notion of a conditional decision net is developed. The notion is then utilized to analyze the consumer models. The characteristic function approach is found to be extremely fruitful in this analysis for conceptualizing the structure of a complex decision process graph, especially the conditional graph; and for yielding insights into the question of simple versus complex models. Some implications about the form and character of decision processes are also drawn. Author

N71-13494*# Oakland Univ., Rochester, Mich. School of Engineering.
BIOSYSTEMS ENGINEERING RESEARCH. VOLUME 3: PATTERN RECOGNITION OF BIOLOGICAL PHOTOMICROGRAPHS USING COHERENT OPTICAL TECHNIQUES Final Report, 15 Mar. 1969–30 Jun. 1970
J. E. Gibson, J. C. Hill, R. E. Haskell, G. A. Jackson, and R. H. Edgerton Nov. 1970 179 p refs
(Grant NGR-23-054-003)
(NASA-CR-115806; TR-70-7-Vol-3) Avail: NTIS CSCL 06D

Random patterns in photomicrographs can be recognized by studying the nature of coherent light diffracted by the spatial pattern. Techniques for measuring the power spectrum and autocorrelation function of random spatial signals are described.

These techniques include both holographic and nonholographic methods. A computer program for generating random patterns with known statistics is presented. Results of power spectrum and autocorrelation measurements are given together with theoretical curves for a variety of spatial signals. Author

N71-13495# Illinois Univ., Urbana. Coordinated Science Lab.
RECENT DEVELOPMENTS IN MAJORITY-LOGIC DECODING
C. L. Chen and R. T. Chien Sep. 1970 17 p refs
(Contract F30602-70-C-0014; DAAB07-67-C-0199)
(AD-712683; R-487; UILU-ENG-70-232) Avail: NTIS CSCL 9/4

The paper gives a survey of recent advances in majority-logic decoding for linear block codes. General majority-logic decoding algorithms are reviewed. The decoding schemes for product codes and the finite geometry codes are discussed. An improved decoding algorithm for the finite geometry codes is described. The improved decoding algorithm greatly reduces the decoding complexity of the codes. It should make the finite geometry codes very attractive in practical use on error-control systems. Author (TAB)

N71-13496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM TO CALCULATE CONVECTIVE HEAT-TRANSFER COEFFICIENTS FROM HARMONIC TEMPERATURE OSCILLATIONS
Geraldine E. Amling and Ronald G. Huff Washington Dec. 1970 40 p refs
(NASA-TM-X-2147; E-5785) Avail: NTIS CSCL 09B

Two FORTRAN 4 version 13 programs are described which obtain the analytical solutions for convective heat transfer coefficients related to either the phase lag or the amplitude ratio. The first, entitled BL, uses the ratio of the wall to driven hot fluid temperature to calculate the coefficients. The second, entitled JCL, uses the phase lag angle between sinusoidally driven fluid and wall temperature to calculate the heating fluid and coolant convective coefficients. Author

N71-13497*# NUS Corp., Rockville, Md.
MODIFICATION OF CODES NUALGAM AND BREMRAD Mid-Term Progress Report
J. J. Steyn and R. Huang Aug. 1970 27 p refs
(Contract NAS5-11781)
(NASA-CR-115809; NUS-722) Avail: NTIS CSCL 09B

A discussion is given of the modification of the existing gamma photon Monte Carlo radiation transport code NUALGAM and converting the existing analytic bremsstrahlung generation code BREMRAD. The NUAGLAM modifications for the IBM/360 digital computer include transport phenomena such as buildup factors, albedos, fluorescent radiation emission, and simulation of scintillation detector response. The BREMRAD conversion includes internal storage of frequently used coefficient data, logic modification, and translation for operation on the IBM/360 digital computer. Author

N71-13498# Oak Ridge National Lab., Tenn. Reactor Div.
OPERATION OF A SPECIALIZED SCIENTIFIC INFORMATION AND DATA ANALYSIS CENTER WITH COMPUTER BASE AND ASSOCIATED COMMUNICATIONS NETWORK
William B. Cottrell, J. R. Buchanan, and D. W. Cardwell Aug. 1970 53 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3078) Avail: NTIS

The Nuclear Safety Information Center is described as a highly sophisticated scientific information center operated at ORNL for the US Atomic Energy Commission. Its information file, which consists of both data and bibliographic information, is computer stored and numerous programs have been developed to facilitate the use of this information by its diverse users through the many services which the Center performs. In support of its work the Center maintains part of a small communications network which now includes 13 remote terminals (6 in NSIC offices) through which most information is added to the computer and much is routinely retrieved. The supporting programming permits extensive manipulation of the computer stored information as well as interactive telecommunications from all of the remote terminals. The Center is staffed by selected senior laboratory technical personnel who are assigned part time to the Center. Recommendations for the development of an information system for the Coast Guard include an interim system for immediate use prior to the development of the ultimate system. Author (NSA)

N71-13499*# Brown Univ., Providence, R.I. Div. of Engineering.
COMPUTATIONAL WORK AND EFFICIENT COMPUTATION ON GENERAL PURPOSE MACHINES
J. E. Savage [1971] 12 p refs
(Grants NGR-40-002-082; NGR-40-002-090; NSF GK-13162)
(NASA-CR-115820) Avail: NTIS CSCL 09B

A new measure of computational work which was introduced recently is applied to three problems: (1) measurement of the work required to fetch from a store, (2) determination of operating principles for a typical general purpose machine on the basis of the computing power of its storage units and (3) formulation of a minimization problem which provides criteria for determining the cost of a mismatch between storage units. Computational work is a measure of the equivalent number of logical operations performed by machines. Author

N71-13500*# Maryland Univ., College Park. Computer Science Center.
NOISE CLEANING IN BINARY-VALUED DIGITAL PICTURES USING 'PROPAGATION' PROCESSES
Azriel Rosenfeld, Chan M. Park, and James P. Strong (NASA, Goddard Space Flight Center) May 1969 55 p refs Sponsored in part by NASA
(Contract AT(40-1)-3662)
(NASA-CR-115810; ORO-3662-3; TR-69-91) Avail: NTIS CSCL 09B

Methods of cleaning noise in a binary-valued digital picture by using propagation processes are described. Emphasis is placed on the possibility of preserving elongated parts of objects while deleting small nonelongated parts. Author

N71-13501*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
COMPUTER-AIDED DESIGN OF FEEDBACK CONTROL SYSTEMS WITH PLANT PARAMETER VARIATIONS
Heydon Zane Lewis 30 Jun. 1970 146 p refs
(Grant NGR-06-003-083)
(NASA-CR-116771) Avail: NTIS CSCL 09B

Ways to improve feedback control design by means of digital computer techniques are examined. Current design methods are studied at the conceptual level to determine whether reformulation for computer usage is necessary or desirable. Promising methods are examined at the practical level in order to identify advantages and disadvantages of using the computer. The main area of interest is the linear control system whose plant has slowly varying parameters. A primary objective is to remove restrictions currently imposed by the human designer. Author

N71-13502*# Philco-Ford Corp., Palo Alto, Calif.
A PLAN FOR COMPUTER-ASSISTED OPTIMIZATION OF STRUCTURES
R. J. Melosh Dec. 1970 209 p refs
(Contract NAS5-11779)

(NASA-CR-115808) Avail: NTIS CSCL 09B

The implementation of computers in structural optimization is discussed with respect to minimizing structural weight by selecting element sizes from a continuous spectrum. Trusses or frames with relatively few elements, few degrees of freedom, and few constraints were optimized. A plan for automating structural design based on extension of a decade of research is described. The plan identifies the theoretical basis, associated software components, data management, and the sequence calculations for improving a given structural design. Author

N71-13503 Case Western Reserve Univ., Cleveland, Ohio.
SOME NEW TREND TESTS
Malcolm Keith Langman (Ph.D. Thesis) 1969 97 p
Avail: Univ. Microfilms: HC $5.00/ Microfilm $3.00 Order No. 70-4947

Various statistical tests for trends in data are presented. Some of the tests are based on variation in run length. Both the small sampling and limiting distributions of the tests are derived, and the tables for the small sample case are tabulated. The power is considered under the alternative of periodicity. The tests have wide application because they are sensitive to most trends. Another class of tests developed is based on correlation. Distribution properties are deprived for this class. The tests appear superior to competitors such as rank correlation. Finally the correlation type tests are developed into randomized tests, and the distribution properties of the randomized tests are analyzed. Dissert. Abstr.

N71-13504*# RAND Corp., Santa Monica, Calif.
COMPUTER SYSTEMS ANALYSIS IS METHODOLOGY: STUDIES IN MEASURING, EVALUATING, AND SIMULATING COMPUTER SYSTEMS
B. W. Boehm Sep. 1970 50 p refs
(Contract NAS12-2144)
(NASA-CR-115807; R-520-NASA) Avail: NTIS CSCL 09B

The results of a group of computer systems analysis and simulation studies are summarized. The discussion, which concentrates on the key results of individual studies and their applicability to the design, development, and management of complex computer systems, should be of interest to planners, managers, and analysts of both complex computer systems and mission-oriented systems. The studies were coordinated into three major efforts: (1) the development of a set of design principles for languages to model and simulate computer systems by attempting to design and implement a prototype language called Extendable Computer System Simulator, (2) the evaluation and extension of the state-of-the-art of using software and hardware devices to measure and analyze the performance of complex computer systems, and (3) the provision of greater perspectives on the relationship between computer performance and man-computer performance by performing and analyzing controlled experiments in man-computer problem-solving. Author

N71-13505# Joint Publications Research Service, Washington, D.C.
AUTOMATIC PATTERN RECOGNITION
V. P. Peressda 10 Dec. 1970 113 p refs Transl. into ENGLISH of the book "Avtomaticheskoye Raspoznavaniye Obrazov" Leningrad, Energiya Press, 92 p
(JPRS-51963) Avail: NTIS

A discussion is given of the theoretical principles of the automatic pattern recognition problem based on decision making theory in multidimensional statistics. Parallels between the one dimensional and multidimensional problems and between analog and digital representation of the variables are presented. The generality of the approach to pattern recognition from the point of view of mathematical statistics and information theory is pointed out. The mathematical apparatus used in the book makes it possible for engineers to evaluate the parameters of recognition automata with respect to given statistical characteristics of the investigated objects. The book is intended for engineers and specialists working in the field of automation of the control of complex processes and dealing with the problem of data processing and generalization of large volumes of data. It can also be useful to students in the advanced courses of the institutes specializing in technical cybernetics. Author

N71-13506# RAND Corp., Santa Monica, Calif.
COMPARING BEHAVIOR AT VARIOUS COMPUTER DISPLAY CONSOLES IN TIME-SHARED LEGAL INFORMATION
James H. Carlisle Sep. 1970 46 p refs Prepared in cooperation with Yale Univ.
(AD-712695; P-4448) Avail: NTIS CSCL 9/2

The objective of the research methodology project is to examine the man-machine interaction which takes place at the remote console of a time-shared computer. An analytical technique utilizing a multivariate discriminate analysis is employed in order to compare behavior at different consoles. From this discriminate analysis, some critical differences between consoles are identified and measured. Author (TAB)

N71-13507*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
AND TREE COMPUTER DATA STRUCTURES FOR SUPERVISORY CONTROL OF MANIPULATION
Philip A. Hardin (Ph.D. Thesis) Oct. 1970 229 p refs
(Grant NGL-22-009-002)
(NASA-CR-115812; DSR-70283-16) Avail: NTIS CSCL 09B

A supervisory controlled manipulation system which can accomplish complex manipulation tasks on unmanned space vehicles is discussed. The system, which presumably knows the initial positions of all objects involved in the task, is given an operator's description of the desired final goal state of the objects in the task. It uses this description to generate a set of sub-tasks, each of which describes moving one object to a final position designated by the goal state description. The system is divided into two parts. The upper level is an AND TREE which orders the sub-tasks so their combined solution results in the solution of the complete task. The lower level consists of a procedure to generate the state spaces which describe a sub-task and a set of shortest path algorithms which find a path through the state spaces, thus finding the solution of the sub-task. The system was implemented on a digital computer, and the manipulator jaws and object of the task site were simulated by a two-dimensional computer model. Six example tasks solved by the system are presented. Author

N71-13508*# Stanford Univ., Calif. Dept. of Computer Science.
TOWARDS AUTOMATIC PROGRAM SYNTHESIS
Zohar Manna and Richard L. Waldinger (Stanford Res. Inst.) Jul. 1970 56 p refs *Its* Memo Aim No. 127
(Contracts NAS12-2221; F19628-70-C-0246; ARPA SD-183)
(NASA-CR-115811; AD-711395; CS-174) Avail: NTIS CSCL 09B

An elementary outline of the theorem-proving approach to automatic program synthesis is given, without dwelling on technical details. The method is illustrated by the automatic construction of both recursive and iterative programs operating on natural numbers, lists, and trees. In order to construct a program satisfying certain specifications, a theorem induced by those specifications is proved, and the desired program is extracted from the proof. The same technique is applied to transform recursively defined functions into iterative programs, frequently with a major gain in efficiency. It is emphasized that in order to construct a program with loops or with recursion, the principle of mathematical induction must be applied. The relation between the version of the induction rule used and the form of the program constructed is explored in some detail. Author (TAB)

N71-13509*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN AND OPERATING CHARACTERISTICS OF A CENTRALIZED ON-LINE DATA PROCESSING SYSTEM AT LANGLEY RESEARCH CENTER
Sheldon Kopelson and Joseph D. Nolan Washington Dec. 1970 42 p refs
(NASA-TN-D-6088; L-6415) Avail: NTIS CSCL 09B

A centralized on-line data processing system providing concurrent service for five test facilities is described. A real-time data acquisition program and a quasi real-time data reduction program operate in a multiprogramming-multiprocessing computer which is interfaced to a central data recording facility serving a large number of test sites. Computed results are returned through a remote terminal system. Five non-time-critical programs may execute in the computer along with the on-line software. Memory requirements for the on-line software are minimized by automatically adjusting the field length of the data acquisition program to the number of active sites and by overlaying all test side reduction overlay was anticipated and special protective software insures the operation of the system for the remainder of the test sites. Author

N71-13510# Illinois Univ., Urbana. Coordinated Science Lab.
THE APPLICATION OF THE PLASMA DISPLAY TECHNIQUE TO COMPUTER MEMORY SYSTEMS
Roger Laverne Johnson (Ph.D. Thesis) Apr. 1970 160 p refs Sponsored in part by ARPA
(Contract DAAB07-67-C-0199)
(AD-712698; R-461; UILU-ENG-70-206) Avail: NTIS CSCL 9/2

In 1966 at the University of Illinois, Professors D. L. Bitzer and H. G. Slottow announced the invention of a flat, multi-cell, gas discharge display with inherent memory. The device, called the Plasma Display Panel, is a high density matrix of bistable, light emitting gas discharge elements with the capability of being randomly written or erased. Although the principal application of the Plasma Display technique is the visual display of digital information, considerable interest is developing in the application of the technique to several types of general computer and computer terminal memory systems. The object of the research and development described in the thesis was to determine the feasibility of using the Plasma Display technique in read/write memory system applications. Author (TAB)

N71-13511# Bettis Atomic Power Lab., Pittsburgh, Pa.
APPLICATION OF CLASSICAL INDUSTRIAL ENGINEERING TECHNIQUES TO SYSTEMS ENGINEERING
Stephen W. Wuchina Jul. 1970 46 p refs Submitted for publication
(Contract AT(11-1)-GEN-14)
(WAPD-T-2311) Avail: NTIS

Several basic tools and techniques used by practicing industrial engineers that have a direct bearing on computer situations are presented. Techniques for operational improvements through measurements of men, machines, and equipment in a data processing environment are considered. A specific systems application for planning, scheduling, and controlling a data processing operation is described. The system is depicted in its logical form of development and application, using the described techniques as a basis. NSA

N71-13512# Naval Postgraduate School, Monterey, Calif.
THE NPS LISP 1.5 VERS 1 PROGRAMMING SYSTEM
John C. Pilley (M.S. Thesis) Apr. 1970 107 p refs
(AD-712779) Avail: NTIS CSCL 9/2

The design and implementation of the NPS LISP 1.5 VERS 1 programming system is described. NPS LISP 1.5 VERS 1 is a complete programming system built around the original implementation of LISP 1.5 on the IBM 360/67 computer at the Naval Postgraduate School. The new version includes a Supervisor and an Editor, as well as the original LISP Interpreter. The VERS 1 system is written in PL/I for time-sharing operation on the IBM 360/67 computer. Author (TAB)

N71-13654*# Texas Univ., Austin. Electronics Research Center.
[COMPUTER DESIGNING AND PROGRAMMING] Final Report
16 May 1970 359 p refs
(Grant NGR-44-012-144)
(NASA-CR-115819) Avail: NTIS CSCL 09B

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N71-13655*# Texas Univ., Austin.
THE FORTRAN PARALLEL TASK RECOGNIZER
In its Computer Designing and Programming 16 May 1970 94 p refs (See N71-13654 04-08)
Avail: NTIS

The FORTRAN parallel task recognizer is a program which accepts as input a source program also written in FORTRAN. As output the recognizer generates a list of tasks within the source program which can be executed in parallel. A graph model upon which the program is based is reviewed, and the working mechanisms of the recognizer program are described in detail. Author

N71-13656*# Texas Univ., Austin.
A SURVEY OF TECHNIQUES FOR RECOGNIZING PARALLEL PROCESSABLE STREAMS IN COMPUTER PROGRAMS
C. V. Ramamoorthy and M. J. Gonzalez *In its* Computer Designing and Programming 16 May 1970 16 p refs Reprinted from AFIPS Conf. Proc., v. 35 p 1-15 (See N71-13654 04-08)
Copyright. Avail: NTIS CSCL 09B

An investigation was conducted of the many implications created by processing in parallel independent segments of individual programs. The effort described includes: (1) the automatic detection of the parallel processable segments; (2) the determination of the suitability of a program for parallel processing; and (3) machine organization to implement parallel processing techniques. Author

N71-13657*# Texas Univ., Austin.
RESOURCE ALLOCATION AND THE AVOIDANCE OF DEADLOCKS

In its Computer Designing and Programming 16 May 1970 15 p refs (See N71-13654 04-08)
Avail: NTIS CSCL 09B

The objective of the research effort reported is the development of a unified software/hardware package, with the hardware part composed of fast, possibly microprogrammable cellular array modules easily adaptable to LSI implementation and dedicated to perform functions related to the dynamic resource allocation activities in a multiprocessing system. Author

N71-13658*# Texas Univ., Austin.
FAST MULTIPLICATION CELLULAR ARRAYS FOR LSI IMPLEMENTATION
C. V. Ramamoorthy and S. C. Economides *In its* Computer Designing and Programming 16 May 1970 11 p refs (See N71-13654 04-08)
Avail: NTIS CSCL 09B

The inherent capabilities of large scale integration technology have directed attention toward two major concepts in the design of functional computer subsystems: the functional module concept and the cellular array concept. The objective of the research reported is to combine the two approaches in the realization of a binary cellular array multiplication unit easily adaptable to the LSI realization techniques and speculate the possibilities of the realization of other similar such functional units aiming to lower the cost per unit of computation and possibly increase the overall system reliability. The methodology and retroactive design procedures of the multiplication array are presented. Interconnection arrangements at the cell level as well as at the module level, for the purpose of assembling larger multiplication units, are also shown. Other LSI considerations in terms of cell or module fan-in/fan-out, total number of pins required per package, chip sizes and densities, and rough cost estimates are also discussed. D.L.G.

N71-13659*# Texas Univ., Austin.
A SURVEY OF RESOURCE ALLOCATION DISCIPLINES IN MULTIPROCESSING SYSTEMS
In its Computer Designing and Programming 16 May 1970 31 p refs (See N71-13654 04-08)
Avail: NTIS CSCL 09B

An algorithm and the associated implementation of a mechanism to allocate the available resources to the various competitors, are two of the most important considerations in the operation of multiprocessing and pure-time shared systems. Because of the inherent characteristics, type of service, mode of operation, and various degrees of availability required from different types of resources, algorithms tend to naturally fall into three basic categories: (1) algorithms for CPU allocation, (2) algorithms for main memory allocation, and (3) algorithms for I/O device allocation. Some of the most commonly used algorithms for the allocation of resources of these three types are presented as applied to multiprocessing or pure-time sharing environments. Emphasis is placed on the various disciplines, assumptions, and trade-off decisions involved. D.L.G.

N71-13660*# Texas Univ., Austin.
A HEURISTIC OPTIMIZATION ALGORITHM FOR ARRANGING AN N PAGE OPEN STRING
In its Computer Designing and Programming 16 May 1970 36 p (See N71-13654 04-08)
Avail: NTIS CSCL 09B

Research is reported aimed at the development of a heuristic optimization algorithm which offers a cost per node ratio that does not increase factorially. Detailed descriptions are given of the steps involved in the accomplishment of this effort. The algorithm was applied to various problems based upon random jump frequencies. The results are presented for a complete graph of 10 nodes which was incrementally reduced to a 5 node graph. D.L.G.

N71-13661*# Texas Univ., Austin.
A CLASSIFICATION AND SURVEY OF COMPUTER SYSTEM PERFORMANCE EVALUATION TECHNIQUES
In its Computer Designing and Programming 16 May 1970 34 p refs (See N71-13654 04-08)
Avail: NTIS CSCL 09B

The widely distributed software capabilities coupled with increased compatabilities among hardware units is propagating an ever increasing multitude of computer systems. Such systems aim at a common goal - total system optimization. But achievement of this ultimate goal is being delayed by the absence of a theoretical basis capable of providing a reference for standardized evaluations and comparisons. The current computer system performance evaluation technology cannot be described in terms of standardized techniques involving established parameters. However, the technology can be partitioned with respect to system component (computing job, hardware unit, and operating system). Within these classifications the material presented examines the methodology (analysis, simulation, synthesis) and parameters of typical evaluation techniques presently available. Their advantages and disadvantages are delineated. A comprehensive bibliography is provided both for specific references and for general information. Author

N71-13662*# Texas Univ., Austin.
UNIFIED HARDWARE/SOFTWARE DESIGN
In its Computer Designing and Programming 16 May 1970 17 refs (See N71-13654 04-08)
Avail: NTIS CSCL 09B

The problem considered is the synthesis of a system to operate in a known environment whose operation could be broken down into a collection of subtasks (computer instruction, instructions, operations, functions, etc.) with a performance criteria defined over these subtasks (i.e. execution time or cost, power, weight, etc.) subject to appropriate constraints. The problem is to select among various methods of implementing the subtasks in order to optimize the performance of the overall system. Solution techniques involving mixed hardware/software considerations are discussed with emphasis placed on an efficient, rapid, near-optimal approach. Author

N71-13663*# Texas Univ., Austin.
ORGANIZING A SPECIAL PURPOSE COMPUTER USING THE FFT TO PERFORM SPEECH ANALYSIS IN REAL TIME
In its Computer Designing and Programming 16 May 1970 89 p refs (See N71-13654 04-08)
Avail: NTIS CSCL 09B

Research was conducted to develop design parameters and the architecture for a special purpose digital computer for speech analysis. Discussions concerning the effort are presented and include: (1) areas of application for speech processing equipment; (2) structure and characteristics of speech which influence the specifications for a speech analyzer; (3) explanation of the operation and properties of the fast Fourier transform as related to hardware design considerations; (4) use of cepstrum analysis for the purpose of pitch extraction; (5) advantages of guiding special purpose hardware for applications such as a speech processor; and (6) review of basic organization options. The design of a speech analyzer using the fast Fourier transform and cepstral analysis was developed. The architecture of the analyzer is described and a summary of the hardware implementation is given. Author

N71-13664# General Electric Co., Cincinnati Ohio. Nuclear Systems Programs.
HOT MICROHARDNESS PROGRAM, MICHRD
H. R. Baumgardt and J. L. Kamphouse 1 Dec. 1969 55 p
(Contract AT(40-1)-2847)
(GEMP-725) Avail: NTIS

MICHRD is a FORTRAN IV program which was written

for the GE-635 computer. The program computes the Vickers pyramid number, VPN, and, when an "irradiated" and a control specimen are being compared, the microhardness increment fraction The VPN is computed from filar micrometer eyepiece readings expressed in filar units. Both the VPN and the increment fraction may be plotted versus temperature. Author (NSA)

N71-13826# Advisory Group for Aerospace Research and Development, Paris (France).
DATA HANDLING DEVICES
Irving Gabelman, ed. Nov. 1970 368 p refs Presented at the AGARD Avionics Panel Tech. Symp., Istanbul, 1 – 4 Jun. 1970 (AGARD-CP-67) Avail: NTIS

Papers are presented on the design and development of equipment for data storage, recording, processing, display, and communications systems. For individual titles, see N71-13827 through N71-13854.

N71-13827# Radio Corp. of America, Princeton, N.J.
THE HIERARCHY OF STORAGE AND MEMORY DEVICES
Jan A. Rajchman *In* AGARD Data Handling Devices Nov. 1970 13 p refs (See N71-13826 04-08)
Avail: NTIS

Data processing systems use a hierarchy of devices for storing information of decreasing storage capacity and increasing speed: magnetic tapes, disk packs, drums, core memories, and transistor memories. Internal system programming and structuring of information being processed can be devised so as to minimize block transfers of information from one device to the next. It is found that additional members can bridge the large speed discrepancy between consecutive devices in the hierarchy and thus increase throughput and simplify internal software. Among these is a relatively large transistor memory (cache) between the core and the processor, and a relatively large core memory (extended core) or else a block oriented random access memory (BORAM) between the disk and the main core. The technologies of these memories, as well as various types of integrated magnetic memories, and of the disk are discussed in the framework of the total storage hierarchy. Author

N71-13828# Litton Systems, Inc., Van Nuys, Calif. Data Systems Div.
SURVEY OF MAIN MEMORY TECHNIQUES
E. I. Bosch *In* AGARD Data Handling Devices Nov. 1970 9 p (See N71-13826 04-08)
Avail: NTIS

Main memory techniques are compared and three advanced memory systems currently in development are described. The memory techniques compared are core memories, including 3D, 2 1/2D, and 2D organizations; magnetic film memories, including planar films, plated wires, mated films, and the post-and-film memory; and semiconductor (LSI) memories, including bipolar and MOS. The 2 1/2D memory uses monolithic circuits resulting in very favorable cost, reliability, weight, and volume. The post-and-film memory offers the desirable combination of low power and high speed, resulting from rotational switching in the magnetic film. The LSI memory uses p-channel MOS devices packaged in hybrid modules. It is concluded that core memories will remain the dominant form of computer main memories for at least the next five years, but that during this time a transition to thin film memories will be seen. Author

N71-13829# Siemens A.G., Munich (West Germany).
HIGH SPEED MEMORIES
H. Rogge *In* AGARD Data Handling Devices Nov. 1970 9 p refs (See N71-13826 04-08)
Avail: NTIS

The fast increase in speed over the past few years will continue over the next decade. Core memories will still be used especially in existing designs and large arrays. But their monopoly has been broken. Thin film memories with plated wire will overtake the high speed portion of the magnetic memories. Semoconductor memories are used already and will enlarge their role to a dominating factor in the mid-seventies. The large semiconductor manufacturers have to compete at that time with a lot of special semiconductor memory companies. The dominating role of mechanically moved magnetic storage mediums as drums, disks, and tapes for high capacities will be attacked by optical memories, but this will not occur within the next few years. Author

N71-13830# Sperry Rand Corp., St. Paul, Minn. UNIVAC Div.
MEDIUM-SPEED, RANDOM-ACCESS MASS MEMORY MODULE
R. E. Boylan *In* AGARD Data Handling Devices Nov. 1970 16 p refs (See N71-13826 04-08)
Avail: NTIS

The design is described of a medium-speed, random-access mass memory module which has magnetic cylindrical thin film (plated wire) storage elements. The memory module will have a storage capacity of approximately 10 million bits and can be expanded to 100 million bits by the addition of storage units. A summary of the memory characteristics is included. The operation of the plated wire storage element is described with emphasis on the features which led to the choice of this type of element for a large capacity memory. The memory system organization, functional characteristics, and interface system used for a typical computer are described. Descriptions of major circuit configurations are included. The mechanical design of the memory module is described, including the memory stack and circuit packaging. Author

N71-13832# Lignes Telegraphiques et Telephoniques, Conflans-Sainte-Honorine (France).
READ ONLY MEMORY [MEMOIRE PERMANENTE]
P. Leduc *In* AGARD Data Handling Devices Nov. 1970 7 p In FRENCH (See N71-13826 04-08)
Avail: NTIS

For microprogram storage tables, a permanent or semipermanent memory is developed. The information is materialized by the presence or absence of magnetic material, the latitude point direction of the word lines, and the reading of the lines. The magnetic material is on a permalloy anistropic uniaxial film from which an oblique axis is obtained for command lines. According to command lines the signal lines are not positive and reading lines are not coupled. The cycle time is 70 nanoseconds. Transl. by E.H.W.

N71-13833# Electronique Marcel Dassault, St. Cloud, (France).
INITIATION OF THE MAGNETIC DIGITAL RECORDER SYSTEM EMMANUAL [SYSTEME D'ENREGISTREMENT MAGNETIQUE NUMERIQUE EMBARQUE EMMANUEL]
C. Meyer *In* AGARD Data Handling Devices Nov. 1970 13 p In FRENCH (See N71-13826 04-08)
Avail: NTIS

A description is given of the system and the equipment test. Emphasis is placed on a comparison of the systems, its precision quality, and the storage work facility where a small digital processor is used as the central command organ. Possible applications and preanalysis techniques are discussed. Transl. by E.H.W.

N71-13834# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
DIGITAL REGISTRATION OF RADAR RETURNS
E. P. Baars *In* AGARD Data Handling Devices Nov. 1970 14 p (See N71-13826 04-08)

Avail: NTIS

A radar data acquisition system and its requirements are discussed. A device is described which digitizes and records on magnetic tape the radar echo vector in amplitude and phase with an accuracy of 8 bits and a sample rate of 1 MHz or alternatively the secondary radar reply in 1 bit and a 6 MHz rate. Author

N71-13835# Standard Electrik Lorenz A.G., Stuttgart (West Germany).
INFORMATIK TERMINAL LO 380: NEW DATA PRINTER OF STANDARD ELEKTRIK LORENZ AG
B. Cramer *In* AGARD Data Handling Devices Nov. 1970 11 p (See N71-13826 04-08)
Avail: NTIS

Apart from its special technical features the technical solutions found for the equipment design deserve special interest. New approaches were evolved in particular for the design of the print unit in order to be able to make use of the advantages of mechanical printing by type levers and at the same time achieve the required printing speed. Underlying the design of the data printer is the call for a transmission speed of 200 bits/sec. It takes further into consideration that 7-bit codes, as for example the ASCITT code or the CCITT Alphabet No. 5, will be of highest importance in the future. In order to fully exploit the advantages of these codes, the equipment has been designed to print 128 characters. This means that graphic symbols can be allocated to all code combinations. Author

N71-13836# Sperry Gyroscope Co., Ltd., Bracknell (England).
AN AIRBORNE DATA ACQUISITION SYSTEM INCORPORATING A RECYCLING METAL TAPE FLIGHT DATA RECORDER
A. T. MacDonald *In* AGARD Data Handling Devices Nov. 1970 24 p (See N71-13826 04-08)
Avail: NTIS

Changes in crash recorder legislation have allowed the introduction of a recycling recorder, in an airborne data acquisition system. The electronic unit accepted a wide variety of analog signals multiplexes and digitized them. The output is a serial pulse code modulated data stream, of 64 words per second for each of 16 bits. The recorder uses 0.5 inch wide 0.0005 inch thick metal tape and operates in a reciprocating mode with a parking density of one thousand bits per inch. Data recovery is accomplished at six times record speed; the output can be analog trace or digital. The method of system integrity checking is described using special purpose test equipment. An appendix derives the dynamic response of the recording process and indicates how playback compensation is used to increase recording density. Author

N71-13837# International Business Machines Corp., New York.
REMOTE DATA ACQUISITION TERMINALS FOR AVIONICS AND SPACE SYSTEMS
W. R. Bauer *In* AGARD Data Handling Devices Nov. 1970 23 p refs (See N71-13826 04-08)
Avail: NTIS

From the systems standpoint, it is shown that decentralized types consisting of remote data acquisition units (RDAUs) and a programmer/controller or processor are the most effective means to meet the ever increasing data requirements of large space and avionic vehicles. Design concepts for an RDAU using hybrid integrated circuits (ICS) are presented. The RDAU described includes the functions of multiplexing, analog to digital conversion, digital control, amplification, and limit storage. The general design approach is to assign each of these functions to an IC module or component. Two of the required functions have been developed, and work is currently in progress on the remaining three. Test results are given for a programmable gain differential amplifier, a component which is attractive for increasing system flexibility and decreasing system weight and cost. Preliminary first- and second-level packaging schemes are also discussed along with advantages and disadvantages of each approach. Author

N71-13838# Compagnie Generale de Telegraphie sans Fil, Saint Egreve (France).
PRESENTATION OF A NEW FAMILY OF STORAGE TUBES: THE STORAGE TUBE RECORDING TIME IS 1238 AND 1239 [PRESENTATION D'UNE NOUVELLE FAMILLE DE TUBES A MEMOIRE: LES TUBES MEMOIRE ENREGISTREURS TME 1238 - TME 1239]
B. Courten *In* AGARD Data Handling Devices Nov. 1970 15 p In FRENCH (See N71-13826 04-08)
Avail: NTIS

A description of the physical principles of different types of memory functions for storage tubes is given. Applications in the area of television and radar or sonar information are discussed. Cost estimates for utilization and product development are included. Transl. by E.H.W.

N71-13839# Radio and Space Research Station, Slough (England).
EXPERIENCE WITH A DIGITAL MAGNETIC-TAPE DATA-LOGGER
C. R. Boulton *In* AGARD Data Handling Devices Nov. 1970 7 p (See N71-13826 04-08)
Avail: NTIS

An experimental data recording apparatus was developed to produce IBM-compatible digital magnetic tapes, using an incremental tape-recorder. Up to six channels of analog information can be recorded. The channels are sampled sequentially and each sample represented as a six-bit binary number. Recording speeds of up to 500 binary characters per second enable six signals each containing frequencies as high as 30 Hz to be recorded. The system will record at any preset speed from the fastest rate down to one sample every 15 seconds, and the length of a block of information written to tape can be preset to any convenient value. Facilities for calibration and the recording of time information are included. Experience in using the system has shown that it is desirable to be able to read magnetic tapes on line as well as write them. The apparatus has been used with experiments in radio propagation using a 25-meter diameter steerable aerial, and on recording rapid variations in the refractive index of the troposphere using balloon-supported equipment. Successful power spectrum and correlation analyses were performed using the magnetic tapes directly on an ICL 1905 computer. Author

N71-13840# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
DIGITAL RADAR DATA TRANSMISSION
E. Hanle *In* AGARD Data Handling Devices Nov. 1970 13 p refs (See N71-13826 04-08)
Avail: NTIS

Two radar systems with digital extractors and a data transmission unit to combine the data from both systems in one computer are used for studying tracking problems. For optimum synchronization special information interlaced to the radar information is fed to the modems. These synchronization blocks with the same length as the target blocks have pseudonoise characteristics and are produced in a feedback shift register, which also serves for the time control of the whole data transmission process. It is shown, that simple parity information added to every block in combination with the synchronization blocks gives enough security against errors in transmission of radar information. Author

N71-13841# Marine Corps, Washington, D.C. Systems Design and Programming Branch.
US MARINE CORPS OPTICAL SCANNING FOR

JUMPS/MMS
Kenneth A. Button *In* AGARD Data Handling Devices Nov. 1970 13 p (See N71-13826 04-08)
Avail: NTIS

A description is given of the total systems approach to the joint uniform military pay system and manpower management system (acronym: JUMPS/MMS) with emphasis on OCR input procedures. Testing thus far has proven highly satisfactory. Author

N71-13842# Siemens A.G., Munich (West Germany).
DATA HANDLING AND MESSAGE SWITCHING IN ATC: COMMUNICATION ORIENTED COMPUTER SYSTEMS
F. Roescheisen *In* AGARD Data Handling Devices Nov. 1970 15 p (See N71-13826 04-08)
Avail: NTIS

The general structure and design of information systems for military and business management use is discussed. These integrated systems are built up in form of networks, generally with several centers. Information systems can be composed from components of the public networks, complemented by privately designed and operated terminals and/or centers. They perform switching functions as well as those syntactical and semantical processing functions, which are related to communications. Communication computers require their own specific hardware and software organization. This organization is described by reviewing a new communication oriented computer system, the Siemens System DC 100. Author

N71-13843# Norwegian Defence Research Establishment, Kjeller.
COMPACT COMPUTER CONTROL SYSTEM FOR SHIP-BORNE MISSILE CHECKOUT AND LAUNCH
Yngvar Lundh *In* AGARD Data Handling Devices Nov. 1970 8 p (See N71-13826 04-08)
Avail: NTIS

A very small general purpose computer is being used for geometric calculations such as vector equations and coordinate transformations for ship borne fire control. The same computer is used for automatic missile check out and for self checking of the complete system. It also performs automatic sequence control of the starting of missile guidance and ignition sequence. The computer is integrated with other electronic system components as a black box, and needs no specialists for operation. Two features are of main interest: The complete system, of which this is a part, includes additional computing capacity, such that each computer solves a part of the complete task, and the computers communicate with each other in a simple way. Secondly, the system including computer and interface is noteworthily compact, and is designed for operation on board small boats by personnel with very little special training. Author

N71-13844# RAND Corp., Santa Monica, Calif.
THE RAND VIDEOGRAPHIC SYSTEM: AN APPROACH TO A GENERAL USER-COMPUTER GRAPHIC COMMUNICATION SYSTEM
Keith W. Uncapher *In* AGARD Data Handling Devices Nov. 1970 12 p refs (See N71-13826 04-08)
Avail: NTIS

The most helpful, flexible, and useful man machine communications path is via a CRT display suitably augmented with flexible input device capability. The problem becomes how to supply graphics at sufficiently low cost in a form where the users terminal is personal and where the terminal is the general communication instrument between the user and his computer needs. The RAND Video Graphics System is an experiment directed at one implementation of these goals. The design philosophy, the system capability, and operational experience of a general purpose graphics system are described. This system applies recently developed advances in analogue scan conversion and recording techniques to allow high centralization and fast multiplexing of the expensive portion of full graphics displays. It also provides minimization of console site equipment to allow ownership of terminals by individual users. Author

N71-13845# Advisory Group for Aerospace Research and Development, Paris (France).
GRACE: A SOPHISTICATED GRAPHIC DISPLAY SYSTEM
Richard A. Guedj *In its* Data Handling Devices Nov. 1970 10 p refs (See N71-13826 04-08)
Avail: NTIS

The design of an experimental interactive display system is presented. Design philosophy leads to a powerful display processor. This processor executes instructions given in a graphic oriented assembly language. There are two modes of operation and two classes of instructions. The immediate instructions are used like the pseudo-instructions of an assembly language. The core instructions draw graphics. Highlights are on software considerations. Symbolic addressing frame setting, and dynamic structure tracing of a picture are implemented in hardware and accomplished through a page organized memory. This leads to a hardware segmented display file. Some geometrical considerations are examined. Multiple precision description of a display file is proposed for zooming. The above features make a display file compiler easier to write and interface with application programs. Author

N71-13846# Selenia S. p. A., Rome (Italy).
AN EVALUATION OF CERTAIN INTERACTIVE INPUT DEVICES ASSOCIATED WITH COMPUTER DRIVEN DISPLAYS
Asbjorn Hunstad and Bernard M. Brown *In* AGARD Data Handling Devices Nov. 1970 9 p (See N71-13826 04-08)
Avail: NTIS

Computer driven digital displays are used in the real time military and air traffic control environment for PPI presentation of radar information mixed with symbols and alphanumerics, and for tabular presentation of alphanumerics. Interactive processes which involve following a decision tree may be used to improve the communication channel between operator and computer. The rolling ball, light pen, keyboard, and touch wires are evaluated as interactive devices. Operational aspects and effects on system design are considered for single and multidisplay control positions. A discussion is given of the suitability of these devices in performing the functions of designation of a geographical point, indication of a zone or symbol, insertion of functional commands, and insertion of data. Author

N71-13847# Laboratory for Electronic Development of the Armed Forces, Oegstgeest (Netherlands).
INPUT COMMUNICATION ON A SYSTEM FOR TARGET-SIMULATION
W. G. de Jong *In* AGARD Data Handling Devices Nov. 1970 9 p (See N71-13826 04-08)
Avail: NTIS

A description is given of a conversational display system as an information input device for a radar target simulator. The operator input procedure is under program guidance. Computer messages are displayed alpha-numerically. Actual flight data can be represented on a tabular display. A synthetic PPI displays the flight positions. Special features are: (1) an external recycling memory which contains character generation matrices as well as the current display patterns for both the tabular and the PPI display; (2) a magnetic drum containing all possible messages; one single command is sufficient to read a complete message from the drum into the recycling memory; and (3) protection is incorporated against illegal actions and flight parameters outside the permitted ranges. Author

N71-13848# General Telephone and Electronics Labs., Inc., Waltham, Mass. Waltham Research Center.

A FAMILY OF DIGITAL CIRCUIT SWITCHES FOR TACTICAL COMMUNICATION SYSTEMS

M. I. Crystal *In* AGARD Data Handling Devices Nov. 1970 7 p (See N71-13826 04-08)

Avail: NTIS

A family of digital circuit switching centers was designed for tactical military communication systems. The switches will accept wideband digital voice, data, written message, and facsimile traffic. The new circuit switches perform standard circuit switching functions such as channel switching and self monitoring; they also perform additional functions such as channel multiplexing, subchannel switching, subchannel multiplexing, error control, and bit synchronization. With add-on store-and-forward equipment, the switching centers can perform message switching functions. They can operate with facilities control centers to monitor and control link and node performance characteristics. The basic circuit switch is modular; functional hardware and software modules can be added, as required, for extending capacity or functional requirements. The heart of the circuit switch is a digital, time division multiplexed interconnection network. This network, a wired logic device which is controlled by a switch control processor, can be implemented by standard digital memory and logic circuitry. A unique feature of the interconnection network is that its loop/trunk capacity can be extended without increasing the speed of the memory or logic circuitry. Author

N71-13849# Litton Systems, Inc., Van Nuys, Calif. Data Systems Div.

DATA TRANSMISSION AND SWITCHING SYSTEM

E. J. Boubli *In* AGARD Data Handling Devices Nov. 1970 13 p (See N71-13826 04-08)

Avail: NTIS

The data transmission and switching system (DTAS) offers a next-generation capability to tactical forces for improved communications capability in the military environment. DTAS makes maximum use of existing communication channels (radio, wire, etc.) to provide increased speed, accuracy, and reliability in transmitting and printing intelligence, air support, artillery and naval gunfire support, logistics, administrative, and command data. The system requires no new or dedicated circuits to accomplish these functions. DTAS is a highly modular, cost effective solution for transmitting data between a tactical headquarters and lower echelons. Its automated transmission, routing, and printout of messages ensure the elimination of error and prevent the data loss inherent in manual systems. The modularity of the system, in addition to providing for flexibility and growth to meet changing tactical requirements, has impact on the logistics and maintenance of the basic equipment. All elements are composed of only seven different modules and are packaged in only two enclosures. Logistics and maintenance are further enhanced by the use of common microelectronic circuits throughout the system. Author

N71-13850# Signals Research and Development Establishment, Christchurch (England).

AN EQUIPMENT FOR MULTIPLEXING TELEGRAPH CHANNELS OF VARIOUS SPEEDS AND FORMATS USING TIME-DIVISION TECHNIQUES

J. W. Gunning *In* AGARD Data Handling Devices Nov. 1970 11 p (See N71-13826 04-08)

Avail: NTIS

The equipment provides twelve channels each having a capacity of 100 bauds, any desired combination of traffic may be transmitted simultaneously thereby achieving maximum system flexibility. The start-stop channels are coded into a nine element format for character preservation purposes. The synchronous traffic is interleaved with additional data to bring the speed up to the channelling rate of 100 bauds. This additional data is used to convey information relating to the speed of the traffic to the distant demultiplexer. Additional information for link synchronisation and supervisory purposes is also included in the 1200 bauds aggregate, to indicate to the distant terminal the behaviour of the circuit on which it is transmitting. Equipment concepts and early design decisions are described. Author

N71-13851# Societe d'Etudes des Systemes d'Automation, Paris (France).

SEARCH FOR ERROR DETECTOR/CORRECTOR CODES ADAPTABLE TO THE TRANSMISSION OF NUMERICAL INFORMATION [RECHERCHE DE CODES DETECTEURS/CORRECTEURS D'ERREURS ADAPTES A LA TRANSMISSION D'INFORMATIONS NUMERIQUES]

D. Borel *In* AGARD Data Handling Devices Nov. 1970 19 p (See N71-13826 04-08)

Avail: NTIS

Programs are developed to advance solutions to adaptation criteria problems in numerical data transmission. Criteria include percentage of errors detected, percentage of errors to be corrected, and percentage of error corrections. Values for adaptation criteria may be calculated from the program. A list of cyclic codes for aptitude and error control on a suitable message format is given. Transl. E.H.H.

N71-13852# Page Communications Engineers, Inc., Washington, D.C.

A MULTIMEGABIT TRANSMISSION SYSTEM FOR THE TROPOSCATTER CHANNEL

Elmer Thomas *In* AGARD Data Handling Devices Nov. 1970 5 p refs (See N71-13826 04-08)

Avail: NTIS

A functional description of the experimental system is presented. Basic features of the system include MFSK modulation, matched filter detection, time gating, use of a decision threshold computer circuit, and compatibility with existing military transmitters and receivers. Operational flexibility is a major feature of the system; among the variable parameters are bit rate, number of frequencies, and time gate duration. Methods are presented for selection of parameters to optimize links with given restrictions on major system parameters such as, power bandwidth and antenna size. Results of the field test program, which show good agreement between theoretical and experimental performance, are presented. Attainment of the design objective of transmitting 1.2 megabits/second at an error rate of less than 10 to the minus 7th power is established. Author

N71-13853# Page Communications Engineers, Inc., Washington, D.C.

SPEECH-DATA INTERFACE WITH NEW ALL DIGITAL TRANSMISSION SYSTEMS

Elmer Thomas and Albert Emurian *In* AGARD Data Handling Devices Nov. 1970 6 p refs (See N71-13826 04-08)

Avail: NTIS

Digitizers in general and the relative merits of the various classes of techniques available are discussed. The advantages of pulse code modulation (PCM), delta modulation, and differential delta modulation are analyzed and compared. Redundancy reduction techniques such as digital time-assignment-speech-interpolation, (TASI), extreme sampling, adaptive compression and vocoders are discussed. The digital vocoder is treated as a unique device capable of optimizing speech-machine interface efficiency. The potential of the vocoder is examined for a wide range of aerospace-ground communications conditions and stresses. The requirements for a versatile and flexible digitizing system are developed. Some promising approaches to time or spectrum sharing with other data handling devices are also analyzed. Author

N71-13854# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Avionics Lab.

ADVANCED DESIGN TECHNIQUES FOR DEVELOPMENT OF A HIGH RELIABILITY AEROSPACE ULTRA-HIGH FREQUENCY COMMAND VOICE/DATA TRANSCEIVER

W. R. Perrigo, R. G. Erdmann (RCA, Camden, N.J.), and R. A. Saraydar (Electron. Commun., Inc., St. Petersburg, Fla.) *In* AGARD Data Handling Devices Nov. 1970 30 p refs (See N71-13826 04-08)

Avail: NTIS

The design approach to basic problems involved in the development of an all solid state, highly reliable, ultra high frequency (UHF) radio command transceiver is presented. The objective is to provide the UHF communication capability required, (both voice and data transmission), in high performance aerospace vehicles and advanced weapon systems. Microelectronic circuits for receiver, low power control circuitry and RF circuits employing advanced state of the art UHF solid state power devices are discussed. New design concepts such as electronic tuning in lieu of electromechanical tuning and improved frequency stability required for projected data transmissions are presented. Component part requirements, development and control based on reliability requirements, are discussed. The role of the computer in designing portions of the transceiver is also covered. Considerations that led to the development of a multimode UHF command voice/data transceiver with an order of magnitude improvement in reliability, simplified maintenance along with lowest cost of ownership studies are presented and compared with prior equipment performance. New data requirements of advanced weapons systems are discussed. Data modes include frequency shift keying (FSK), digitized speech, teletype and frequency modulation (FM) capability. Design problems encountered by added operating control capability to render the receiver-transmitter capable of use in integrated systems and adaptability for growth in voice and data transmission links are also discussed. A program of development, fabrication and initial testing of a 12 to 18 watt carrier UHF multimode transceiver are discussed. Author

N71-13856# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.

REAL-TIME DATA ACQUISITION AND PROCESSING UNIT INSTALLED AT LIMEIL FOR CARRYING OUT NUCLEAR PHYSICS EXPERIMENTS [PRESENTATION DE L'ENSEMBLE D'ACQUISITION ET DE TRAITEMENT DE DONNEES EN TEMPS REEL INSTALLE A LIMEIL POUR LA REALISATION DES EXPERIENCES DE PHYSIQUE NUCLEAIRE]

Yves Jehannot de Penguer 5 Feb. 1970 16 p In FRENCH Presented at the Meeting of 10020 C2 Users, Louveciennes, France, 16 Dec. 1969

(CEA-Conf-1522; Conf-691217-1) Avail: AEC Depository Libraries

The various parts of the installation are described. The 10020 computer is intended to acquire and process the data in real time. It has to store the data of the experiment itself and to monitor and control the experiment. The measuring channel includes detectors, a shaping and storage electronic unit and analog digital amplitude encoders for pulses of about one microsecond. The data supplied by several encoders may be correlated (time-energy). Monitoring and control data are supplied by cyclic scalers and readings are taken at a fairly slow rate. NSA

N71-13857# Los Alamos Scientific Lab., N.Mex.

SIGNIFICANT DIGIT ARITHMETIC ON A CDC 6600

V. Gardiner and N. Metropolis Jun. 1970 4 p refs

(Contract W-7405-eng-36)

(LA-4470) Avail: NTIS

Subroutines were developed that implement the operations of addition (subtraction), multiplication, and division in significant digit arithmetic on the CDC 6600. Associated input-output routines are also presented that consider the precision of operands. An initial set of library routines was prepared that includes the trigonometric functions and their inverses, as well as the logarithm and exponential functions. These have the property that the precision of the dependent variable reflects that of the independent variable. Comparison of times with FORTRAN equivalents is given. Author

N71-13859# Technische Hochschule Darmstadt (West Germany).

SYSTEMS ANALYSIS AS AN INSTRUMENT FOR PRELIMINARY INVESTIGATIONS OF THE USE OF ELECTRONIC COMPUTERS IN INDUSTRY [SYSTEMANALYSE ALS INSTRUMENT ZUR EINSATZVORBEREITUNG FUER ELEKTRONISCHE DATENVERARBEITUNGSANLAGEN IN INDUSTRIEBETRIEBEN]

Hans Joachim Petzold (Ph.D. Thesis) 1970 235 p refs In GERMAN

Avail: NTIS

The main features of existing operational organisations for the design of electronic information processing systems are analyzed. Cybernetic models and information processes are described and possible computer applications are given. ESRO

N71-13924# Canadian General Electric Co., Ltd., Toronto (Ontario).

HYBRID ANALOGUE/DIGITAL CORRELATOR

C. E. Jagger *In* AGARD Advanced Radar Systems Nov. 1970 16 p refs (See N71-13901 04-07)

Avail: NTIS

A hybrid technique is presented which possesses the desirable features of delay precision inherent in digital filters and dynamic range of analogue devices. Such an ideal seems to be offered by the N-path filter technique, and the bucket-brigade delay line, both of which make use of the zero order hold circuit for information storage. To demonstrate the potential of these devices, elementary matched filters have been implemented at bandpass to operate on signals with time-bandwidth products up to 15. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-13486* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MICROWAVE POWER RECEIVING ANTENNA Patent

Carroll C. Dailey, inventor (to NASA) Issued 20 Oct. 1970 (Filed 1 May 1969) 7 p Cl. 307-149; Int. Cl. H02j1/00

(NASA-Case-MFS-20333; US-Patent-3,535,543; US-Patent-Appl-SN-820965) Avail: US Patent Office CSCL 09E

A microwave power receiving antenna is described having a solid state rectifier circuit comprising a plurality of diodes which converts high frequency energy to direct current. Each enclosure and its corresponding pair of dipoles is mounted on a heat conducting support post, which in turn is mounted on a large antenna reflector. The device effectively solves the problem of heat dissipation by constructing the dipole supporting posts, the antenna reflector, and the dipole elements as heat pipe devices. Each supporting post and the antenna reflector may either communicate for greater efficiency in dissipating heat or be physically separated to simplify fabrication. Brief descriptions accompany drawings of the antenna. E.M.C.

N71-13513*# Cambridge Thermionic Corp., Mass.
DESIGN AND DEVELOPMENT OF A DC MOTOR WITH MAGNETICALLY SUSPENDED ROTOR Final Report, 5 Jul. 1968 – 31 Jul. 1970
31 Jul. 1970 51 p ref
(Contract NAS5-11585)
(NASA-CR-115793) Avail: NTIS CSCL 09E

A project to produce two working units of a permanent magnet 24 volt brushless dc motor with a magnetically suspended rotor is described. The purpose of such a motor is to eliminate mechanical bearings and their attendant wear and lubrication problems under long-term continuous duty in space environments. The suspension system is basically the Cambion dc suspension system. Author

N71-13514*# Cambridge Thermionic Corp., Mass.
MODIFICATION OF DC MOTOR WITH MAGNETICALLY SUSPENDED ROTOR TO GIVE HIGHER MOMENTUM STORAGE CAPACITY, SUPPLEMENT Technical Report, 1 Apr. – 31 Jul. 1970
31 Jul. 1970 21 p
(Contract NAS5-11585)
(NASA-CR-115792) Avail: NTIS CSCL 09E

A 2.1 lb. flywheel was added to the existing rotor which necessitated improving the total magnetic support capability of the bearing by adding two more ridges to each rotor and stator pole face. The ridges increased the support capability of the bearing without increasing the power requirement. A stronger permanent magnet was installed in the rate generator circuit so that a sufficient rate signal could be generated with the increased rotor weight. The existing motor and bearing housing was discarded in favor of a rigid clamping frame to accommodate the six inch diameter flywheel. A portion of the old housing was used to support the motor armature and commutator. These modifications improved the support capability, stiffness, and efficiency with no increase in power consumption. Author

N71-13515# National Defense Research Organization TNO, The Hague (Netherlands). Chemistry Lab.
AEROSOL FILTRATION BY ELECTRIFIED FIBROUS FILTER MATS, 3
P. Ziekman Jun. 1970 15 p refs
Avail: NTIS

The influence of the various electret formation parameters (electric field strength, formation temperature, formation time) on the life time and the degree of polarization, investigated by means of filtration experiments is discussed. It was found that formation time and electric field strength play only a secondary part as far as the ability to retain aerosols is concerned. For the experiments high porosity filters were used consisting of PET (poly ethylene terephtalate) fibres with a diameter of 23 micrometers and a length of approximately 4 mm. Filters of these fibres, when not electrified, exhibit penetrations of 80 to 90% and a very low pressure drop. Turning these filters into electret filters lowers the penetration to < 3% while maintaining the pressure drop at its low value. However, the penetration increases with increasing aerosol load on the filter. An example is given of an electret filter in combination with a mechanically working filter (e.g. glass fibre filter) acting as a prefilter. The pressure drop is determined by the glass fibre filter but the penetration may be 10 to a 100 times lower than for the glass filter alone. Author

N71-13516# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
LIFE TESTING OF SMALL DIAMETER THERMOCOUPLES AS A FUNCTION OF THERMAL CYCLING, TEST NO. 3
W. G. Baxter, D. E. Conner, and W. H. Rauch Oct. 1969 20 p
(Contract AT(40-1)-2847)
(GEMP-713) Avail: NTIS

Seven small diameter (.062") stainless steel sheathed, MgO insulated thermocouples were tested in an air heated, steam cooled thermal cycling test rig. Four Type K (Chromel-Alumel) and three Type T (Cu-Constantan) thermocouples were evaluated through 1387 thermal cycles of 1200 F to 600 F. One Type K thermocouple failed after 732 cycles. The remaining couples were functional at the conclusion of the test. Author (NSA)

N71-13517*# Auburn Univ., Ala. Amplifying Systems Lab.
CLASSIFICATION AND SIGNAL ANALYSIS OF PULSE-WIDTH-MODULATED AMPLIFIERS, PART 3 Annual Report
M. A. Honnell and R. O. Pettus 30 Sep. 1970 78 p refs
(Contract NAS8-11344)
(NASA-CR-102959) Avail: NTIS CSCL 09E

A classification of pulse width modulated amplifiers based on the type of circuitry employed and on the type of modulated waveforms generated is submitted. Graphs showing the computed amplitudes of spectral components in the modulated pulse carrier are presented for the different classes of modulation. Distortion contour curves facilitate the choice of Butterworth filters required to recover the signal with a predicted value of maximum distortion. The effects of non-ideal behavior in pulse width modulated amplifiers are considered. Author

N71-13518* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
HIGH VOLTAGE PULSE GENERATOR Patent
David L. Pippen, inventor (to NASA) Issued 22 Sep. 1970 (Filed 28 Jul. 1969) 6 p Cl. 315-241; Int. Cl. H05b41/14
(NASA-Case-MSC-12178-1; US-Patent-3,530,336; US-Patent-Appl-SN-845365) Avail: US Patent Office CSCL 09E

A captive discharge circuit is described which produces a controlled, high voltage, fixed energy spark. The circuit has a constant known energy output for testing the flash and ignition characteristics of nonmetallic materials in a controlled gas environment, as the oxygen environment of a spacecraft. The charge circuit is manually fired by closing a switch or is automatically fired each time the circuit is prepared to deliver the fixed energy spark by linking the switching mechanism to the relay. The indicator lamp provides a readily discernible signal that the circuit components have been charged to the desired values. Moreover, the elements employed and their manner of interconnection ensure positive resetting of the silicon controlled rectifiers after each cycle in a simple and direct manner and without exceeding design ratings. A schematic circuit diagram of the high voltage pulse generator is given. E.M.C.

N71-13519# National Defense Research Organization TNO, The Hague (Netherlands). Chemistry Lab.
A THEORETICAL STUDY OF AEROSOL FILTRATION BY ELECTRET FILTERS
P. Ziekman Jun. 1970 29 p refs
(Rept-1970-17) Avail: NTIS

From experiments it has become evident that the use of electret filters in aerosol filtration may give rise to a high collection efficiency and at the same time a low pressure drop. An electret is a body in which a certain amount of electric energy is stored, thus causing an external electric field. A method for calculating trajectories of charged particles around a cylindrical fiber in electret filters is described. High porosity filters (porosity 80 - 90%), consisting of electrified fibers of 23 microns in diameter were considered. Calculations have been performed in the interception region (at small Reynolds numbers) using the Kuwabara-Happel stream function. This stream function which depends on the porosity is based on a filter model of parallel cylinders, located at random and with the direction of flow perpendicular to the axes of the cylinders. In order to be able to describe an averaged electric field

in the filter the isotropic model of parallel cylinders at equal distances was chosen. The influence of the electric field on aerosol capture was analyzed. Author

N71-13520# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
WIDE-BAND HOT-CARRIER DIODE GATE WITH APPLICATION TO ELECTRON-HOLE PLASMAS
R. M. Lantz, W. P. Robbins, H. J. Fossum, and B. Ancker-Johnson Sep. 1970 18 p refs
(D1-82-0996) Avail: NTIS

A sampling or tone-burst gating system utilizing hot-carrier diodes was designed and is shown to have the following characteristics: band width, dc to 1 GHz; rise and fall times, typically less than or equal to 3 and 5 nsec; power capability, about 100 mW; gating pulse frequency, 10 Hz to 1 MHz; gating pulse width, 50 nsec to 5 msec; leakage, > 45 dB down at 100 kHz and about 24 dB down at 500 MHz; gate isolation from common ground reference, > 60 dB at all frequencies; input and output impedances, adjustable to match source and load. Since this gating system consists of two identical gates in parallel, it presents a constant impedance to prevent undesirable loading perturbations of the RF source. The gate can be synchronized with an RF signal whose frequency is < or = to 1 GHz and with the described design changes, may be synchronized with a 10 GHz signal. Author

N71-13521* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PARASITIC PROBE ANTENNA Patent
Herbert E. Cribb, inventor (to NASA) Issued 1 Sep. 1970 (Filed 20 Oct. 1967) 4 p Cl. 343-703; Int. Cl. G01r; Int. Cl. H01Q13/00, 1/42
(NASA-Case-XKS-09348; US-Patent-3,526,897; US-Patent-Appl-SN-677505) Avail: US Patent Office CSCL 09E

A low insertion loss C-band parasitic probe for prelaunch testing of spacecraft antennas is described. A housing with the interior lined with RF absorbent material is mounted adjacent to the spacecraft antenna. A spacecraft helix antenna is mounted on a pivotal back plate of the housing with a conventional RF fitting to permit connection to external antennas. A polystyrene rod establishes a low loss path from the spacecraft antenna to the helix antenna. The probe efficiently couples RF energy from a spacecraft to outside antennas and requires less power than the usual probes. N.E.N.

N71-13522* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CAPACITOR AND METHOD OF MAKING SAME Patent
Frank J. Hrach and Solomon S. Papell, inventors (to NASA) Issued 20 Oct. 1970 (Filed 7 May 1969) 4 p Cl. 317-258; Int. Cl. H01g3/06
(NASA-Case-LEW-10364-1; US-Patent-3,535,602; US-Patent-Appl-SN-822518) Avail: US Patent Office CSCL 09A

A method is described for making a capacitor by solidifying a mixture of ferromagnetic particles, nonferromagnetic particles, and a dielectric material in the presence of mutually perpendicular magnetic and electric fields. The mixed particles are retained in a predetermined orientation by a dielectric matrix to form the capacitive body. Electrodes are provided on the body for electrical connections. E.C.

N71-13523*# Weston Instruments, Inc., College Park, Md. EMR Div.
WATT-HOUR METER Final Report
[1970] 116 p
(Contract NAS5-11524)
(NASA-CR-115797) Avail: NTIS CSCL 09D

The watt-hour meter is a versatile and accurate instrument for measuring watt-hours and ampere-hours over a wide range of voltages and currents. The voltage and current inputs can be widely separated in voltage potential from each other and from earth ground with no degradation in measuring performance. In addition, accuracy is maintained over the frequency range from dc to 100 Hz. The watt-hour meter uses voltage-to-frequency conversion techniques in order to obtain a pulse rate which is proportional to the watt-hour and ampere-hour inputs. Four solid state counters in the instrument accumulate and store the positive and negative watt-hours and positive and negative ampere-hours. Each can be selected for display on a six-digit Nixie readout. The output of each counter is commutated into a single six-phase BCD output for printout. Relay contact closure outputs are also provided for each of the four outputs permitting the use of external counters. The voltage and current inputs are indicated on front panel meters. Author

N71-13524# RAND Corp., Santa Monica, Calif.
A TWISTED TURNPIKE THEOREM
Emmett B. Keeler Sep. 1970 20 p refs
(AD-712696; P-4450) Avail: NTIS CSCL 5/3

Weather, conflict, and sectorally uneven technical progress may cause production possibilities to vary with time. This paper generalizes the Morishima turnpike theorem to bounded, but not constant, normalized production possibilities. The variation in the set of efficient paths and prices still becomes small for long programs. However, the turnpike may be twisted, and also difficult to compute. Author (TAB)

N71-13525*# North American Rockwell Corp., Downey, Calif. Space Div.
FLAT CONDUCTOR CABLE TERMINATION DEVELOPMENT PROGRAM Final Report
R. W. Gibb and G. H. Waddy 15 Sep. 1970 52 p
(Contract NAS9-10444)
(NASA-CR-108703; SD-70-378) Avail: NTIS CSCL 09C

Test results indicate that the design concepts described below are suitable for terminating flat conductor cable (FCC) to small electrical components. These components are commonly used on electrical display and control panels, such as event indicators, switches, relays, and circuit breakers. The method chosen for components with screw type terminals was to transition FCC to Etched Flexible Circuitry (EFC) which pick up the component header/terminal pattern and terminate through eyelets or plated through holes in the EFC. The prime concept chosen for use with components with solder terminals was to modify existing component header/terminals to utilize MIL-C-38999 type pin contacts which mate with FCC adapters using mating socket contacts. An alternate concept was used for components having flattened and pierced solder terminals. It consisted of an FCC adapter with spring clip contacts which mated to the existing component after slight terminal modification. Author

N71-13526*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
THERMAL CONTACT RESISTANCE WITH NON-UNIFORM INTERFACE PRESSURES
R. McMillan, Jr. and B. B. Mikic Nov. 1970 100 p refs
(Grant NGR-22-009-477; DSR Proj. 72105)
(NASA-CR-115796; DSR-72105-70) Avail: NTIS CSCL 20C

The effect of roughness and waviness on interfacial pressure distributions and interfacial contact resistance is considered. It is shown that for moderate roughness the contour area could be substantially different from the contour area calculated using the Hertzian theory. The model for pressure calculation assumes plastic deformation of surface irregularities and elastic deformation of a spherically wavy base. The calculations of pressure distributions

cover the range of parameters of practical interest. Experimental contact resistance values have been determined and are compared with theoretical predictions. It was calculated that contact conductance for wavy surfaces can be increased for certain ranges of parameters by making surfaces rough. Author

N71-13827*# Weston Instruments, Inc., College Park, Md. EMR Div.

AIRBORNE ELECTRONIC RESET FUSE Final Report

Jun. 1970 31 p

(Contract NAS5-11559)

(NASA-CR-115791; EMR-POA-1956) Avail: NTIS CSCL 09A

The modifications and optimizations made on a prototype for an electronic reset fuse are reported. Operational test results are given in tables and graphs. E.H.W.

N71-13828*# Assistant Secretary of Defense (Installations and Logistics), Washington, D.C.

ELECTRONIC PARTS SCREENING

Apr. 1970 84 p refs Sponsored by NASA

(NASA-CR-115794; AD-711276; TR-10) Avail: NTIS

The report presents general screening concepts and provides guidelines for the establishment of screening procedures for discrete fixed resistors and discrete transistors. Author (TAB)

N71-13829*# Hughes Research Labs., Malibu, Calif.

DEVELOPMENT OF ION IMPLANTATION TECHNIQUES FOR MICROELECTRONICS

O. J. Marsh, H. Dunlap, R. Hart, and R. G. Hunsperger [1970] 139 p refs

(Contract NAS12-124)

(NASA-CR-111806) Avail: NTIS CSCL 09A

The application of ion implantation to the formation of conducting layers and p-n junctions in GaAs and SiC was studied. Considerable attention was given to the analysis of the formation and annealing of disorder introduced by ion implantation. Techniques such as Rutherford backscattering, reflectivity, and electron channeling patterns were used to analyze disorder. Electrical evaluation of implanted layers, through Hall effect and sheet resistivity measurements, was investigated as a function of annealing conditions. Conducting layers of n- and p-type, with electrical properties similar to bulk grown material, were formed in GaAs by implanting standard n- and p-type dopants and annealing in the layers at 800 C. Conducting n-type layers of good electrical quality were formed in SiC by implanting impurities from column V of the Periodic Table after the layers were annealed at 1600 C. Similar anneal procedures performed on layers implanted with standard p-type dopants did not result in p-type layers in SiC. P-n junctions produced in GaAs and SiC ion implantation had excellent characteristics from 23 to 300 C. Author

N71-13830* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

MICRO CURRENT MEASURING DEVICE USING PLURAL LOGARITHMIC RESPONSE HEATED FILAMENTARY TYPE DIODES Patent

Conrad S. Josies, inventor (to NASA) Issued 26 Jul. 1966 (Filed 5 Mar. 1962) 4 p Cl. 324-132 Sponsored by NASA

(NASA-Case-XNP-00384; US-Patent-3,263,171;

US-Patent-Appl-SN-180392) Avail: US Patent Office CSCL 09E

A rugged, nonswitching, bipolar circuit arrangement for measuring currents in the micromicroampere range is described. Two subminiature thermionic diodes with filamentary cathodes are connected cathode to diode, producing a current which is small compared to the current to be measured. The source of the unknown current is connected to the two diodes, and a meter connected across the diodes measures voltage drop due to the unknown current. When a positive or negative micromicroampere current is applied to the filament diodes, they vary the voltage across them linearly as the logarithm of the current. N.E.N.

N71-13831* Honeywell, Inc., Minneapolis, Minn.

APPARATUS FOR OVERCURRENT PROTECTION OF A PUSH-PULL AMPLIFIER Patent

Daniel J. Sikorra, inventor (to NASA) Issued 1 Sep. 1970 (Filed 19 Dec. 1966) 4 p Cl. 330-11; Int. Cl. H03f3/18, 3/30, 3/50 Sponsored by NASA

(NASA-Case-MSC-12033-1; US-Patent-3,526,845;

US-Patent-Appl-SN-602828) Avail: US Patent Office CSCL 09E

A circuit which provides protection to the amplifier is described. A pair of amplifying transistors (one n-p-n and the other p-n-p) are supplied with voltage biasing circuits coupled to the input of each transistor. Resistors are connected between each transistor and a common node output terminal. Diodes, the voltage breakdown means, are coupled between the common node and each input terminal of the transistors in such a way that when one transistor tries to draw an excessive current, the other transistor is turned off by its diode. A variation of the circuit is also given. N.E.N.

N71-13833# Sandia Corp., Albuquerque, N.Mex.

COMPUTER AIDED DESIGN OF MICROWAVE TRIODE OSCILLATORS

R. J. Chaffin Jul. 1970 42 p refs Sponsored by AEC

(SC-RR-70-497) Avail: NTIS

A grid separated, capacitive feedback microwave triode cavity oscillator is examined. The circuit is analyzed mathematically through the use of elementary oscillator theory. The resulting complex transcendental equations are solved with the aid of a digital computer. The equations are written in a form which allows the determination of the physical constants of the oscillator cavity. The analysis predicts both the frequency of operation and the magnitude of the feedback factor. The derived oscillator model permits one to evaluate the effect of tube and cavity tolerances on the circuit behavior mathematically with a high degree of confidence. Several laboratory models have been designed and built using this computerized approach, and in all cases the agreement between experiment and theory was found to be excellent. Author

N71-13834# Sandia Corp., Albuquerque, N.Mex.

THIN-WIRE CIRCULAR LOOP ANTENNAS OF ARBITRARY SIZE.

L. D. Licking and D. E. Merewether Aug. 1970 75 p refs Sponsored by AEC

(SC-RR-70-433) Avail: NTIS

A comprehensive treatment of the receiving and transmitting properties of the thin wire circular loop antenna is provided. The response of the loop to both CW and transient excitation is considered. The development of the theory is given, numerical data and examples are provided, and listings of the applicable FORTRAN programs are appended. Author

N71-13835# Technische Hochschule Stuttgart (West Germany). Inst. fuer Kernenergetik.

TWO CHANNEL ZERO-POINT TRIGGER; A TRIGGER DEVICE OF HIGH INITIAL SENSITIVITY FOR THE 0.1 Hz TO 2 kHz FREQUENCY REGION [ZWEIKANAL-NULLPUNKTSTRIGGER: EIN TRIGGERVORSATZ MIT HOHER EINGANGSEMPFINDLICHKEIT FUER DEN FREQUENZBEREICH 0, 1 Hz–2 kHz]

R. Mayer Jan. 1969 53 p refs In GERMAN

(Rept-5-73) Avail: NTIS CSCL 09C

Described is a measuring instrument that exactly determines phase differences between two alternating current signals in the frequency region 0.1 Hz to 2 kHz in combination with a digital computer. Basic aspects of measuring functions for the circuit are described and the properties of critical steps in the circuit are calculated. Oscillographic measurements on instrument properties were satisfactory. Transl. by G.G.

N71-13536# California Univ., Livermore. Lawrence Radiation Lab.
MEASURED TIME AND FREQUENCY RESPONSE OF A MINIATURE SUPERCONDUCTING COAXIAL LINE
N. S. Nahman, M. P. Ekstrom, and W. D. McCaa, Jr. (NBS, Boulder, Colo.) 15 Jun. 1970 30 p refs Presented at Applied Superconductivity Conf., Boulder, Colo. Submitted for publication Sponsored by AEC and NBS
(UCRL-73574; CONF-700618-1) Avail: NTIS

A miniature 278 meter long superconducting coaxial transmission line having a lead outer conductor (0.129 cm id), a teflon dielectric, and a niobium center conductor (0.038 cm), was carefully measured in the time and frequency domains. The observed step response (10% to 90%) times were 1.5 microsec at room temperature, 375 nsec. at 77 K, and 140 psec. at 4.2 K. Although the observed step responses were smooth transitions, the observed 0.1 thru 12 GHz swept frequency attentuation when superconducting was oscillatory. For example, near 5 GHz and at 4.2 K the attenuation envelope minimum was 1.1 db, while about 0.5 MHz away the attenuation was 5 db. By incorporating the conductivity measurements into the two fluid model, the lines step response and attenuation were calculated and found to compare favorably with both the step response and attenuation envelope minimums observed. Additionally, the experimental setup, the measurement equipment, and the data reduction methods are discussed. Author

N71-13912# Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany).
INTEGRATED SUBSYSTEMS ON COMPOSITE SUBSTRATES
M. Lemke, P. Holst, and H. J. Schmitt *In* AGARD Advanced Radar Systems Nov. 1970 11 p refs (See N71-13901 04-07)
Avail: NTIS

A new substrate technology for microwave integrated circuits is described, which allows a planar integration of magnetic system functions. The approach used the fact that some substituted ferrites, with Curie points sufficiently below operating temperature of the system, provide an excellent, low-loss nonmagnetic host substrate which can be sintered together with magnetically active zones of similar but unsubstituted ferrites. This technique offers the advantage of reduced coupling and system losses compared to the technique using an all-magnetic ferrite substrate, and avoids the mechanical complexity of conventional dielectric substrates with attached g plug-in ferrite devices. Composite ferrite substrates have been successfully employed for miniaturized latching ferrite phase shifters for phased arrays. The technique has also been used in the development of miniature X-band radar front ends with integrated isolators and circulators and for a pocket-size Doppler radar. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N71-13532 Newark Coll. of Engineering, N.J.
CONCEPTS IN LSI SERVO-CONTROL-ELECTRONICS
Alfons A. Tuszynski (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-4445

Modern concepts of servocontrol theory in the light of recent developments in the technology of monolithic circuits are discussed. Conclusions drawn from the discussion of fabrication constraints and performance requirements lead to a preference for digital implementations. Two types of compensators are discussed: canonic pole zero arrangements with ROM multipliers and Kalman filters with stored program implementations of covariance equations. The concept of pulse width frequency modulation (PWFM) is introduced to reconcile the dynamic range requirements of servocontrol drivers with the time resolution limitations of power transistors. Simple means of implementation of PWFM are also given: The organization of digital systems is examined in order to demonstrate the feasibility of large scale integration (LSI) in servocontrol electronics. The questions of hardware versatility and power dissipation economy are emphasized from technological, economical and applicational standpoints. Self-contained loops and computer aided systems are investigated. Dissert. Abstr.

N71-13537* Hughes Aircraft Co., Los Angeles, Calif.
DIFFERENCE CIRCUIT Patent
John R. Morris, inventor (to NASA) Issued 14 Jul. 1970 (Filed 21 May 1968) 6 p Cl. 73-382; Int. Cl. G01v7/00 Sponsored by NASA
(NASA-Case-XNP-08274; US-Patent-3,520,190; US-Patent-Appl-SN-730703) Avail: US Patent Office CSCL 09C

A simple difference indicating circuit is described having high input impedance, very low noise, small size, and low power requirements. The circuit further provides an output signal proportional to the difference between two low-level voltage input signals. The circuit can be used to generate the difference between two strain gage outputs, and finds particular use in a cross-shaped rotor for measuring a gravity field. The gages are located on the arms of the rotor, and they measure the bending of the arms due to the field as the rotor spins. The output of the circuit is delivered to the input of a radio transmitter for broadcast to a receiver located several inches away. E.M.C.

N71-13538# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
ELIMINATION OF PHASE DISTORTION IN FILTERS USING DIGITAL TECHNIQUES
R. R. Feezell and R. C. Marcum [1969] 19 p refs
(Contract W-7405-ENG-26)
(Y-DA-3514) Avail: NTIS

All linear electrical filters of the analog type contain energy storage devices and operate in real time. The desirable feature of filters is the preferential attenuation of certain frequencies over others, hence the filtering action. By selecting the proper network and sizing the components correctly, almost any desired attenuation characteristic can be obtained as a function of frequency. However, there is a definite relationship between the amount of attenuation and the amount of phase shift which takes place between the input and output of any filter network. If the input is a single-frequency sine wave and periodic, after a few cycles to allow the filter energy storage elements to come to equilibrium, the output will be an attenuated sine wave of the same frequency as the input but attenuated a predictable amount depending on the filter's characteristic. Thus, the output is an attenuated replica of the input, and the filter is said to be free from distortion. The output is shifted in phase with respect to the input, which is another way of saying the output is delayed in time with respect to the input. The amount of phase shift or time delay is a function of the filter's attenuation characteristic and the frequency of the input. Author

N71-13539*# Moore-Peterson Associates, Santa Barbara, Calif.
IDENTIFYING CRITICAL PROBLEM AREAS IN THE MICROELECTRONIC FIELD
6 Apr. 1970 22 p
(Contract NAS12-2225)
(NASA-CR-109754; Rept-3) Avail: NTIS CSCL 09C

Critical problem areas in the microelectronic field are identified and briefly discussed. Major problems deal with: increased complexity of systems; packaging of LSI chips; procurement of

semiconductor devices from commercial sources; development of in-house capabilities by NASA, NSA, Navy, and Air Force to produce micro electronic equipment; microcircuitry; computerized design; computer aided art work and testing; thin film epitaxy; and X-band radar. A.L.

N71-13540# Idaho Nuclear Corp., Idaho Falls.
EXPLODING WIRE AS A DYNAMIC PRESSURE SOURCE
R. H. Meservey and T. C. Piper Jul. 1970 55 p refs
(Contract AT(10-1)-1230)
(IN-1406) Avail: NTIS

A method with which to determine wire behavior during an exploding discharge is described. Using only the original wire dimensions and current and voltage records of the explosion, the following parameters were calculated: (1) wire volume, (2) radius, (3) magnetic pressure, (4) inertial pressure, (5) velocity, (6) acceleration, and (7) electrical energy. Values of the above parameters were calculated for each one half micro second time interval during the explosion. A range of wire sizes was tested at 5 and 10 kV discharges from an energy storage capacitor. The wire explosions were produced in water and the waterpropagated shock wave was measured for each explosion. Correlations between wire behavior and the shock wave energy indicate that the shock energy is proportional to the radial wire velocity and to the electrical energy deposited in the wire. Although the wire melts early in the energy discharge cycle, it is contained by magnetic and inertial forces. Author (NSA)

N71-13541# Royal Aircraft Establishment, Farnborough (England).
ON THE FUNDAMENTAL POSSIBILITIES OF DIGITAL PHASE MEASUREMENT [ZU PRINZIPIELLEN MOEGLICHKEITEN DER DIGITALEN PHASENMESSUNG]
N. Berger Mar. 1970 20 p refs Transl. into ENGLISH from Nachrichtentechnik (E. Berlin), v. 17, no. 11, 1967 p 443–446
(RAE-Lib-Tran-1428) Avail: NTIS

The principles of well known and new possibilities of digital phase measurement are reviewed. A quantization of the phase value is attained by time quantization, statistical investigation, phase frequency transformation, sampling scanning, analog-digital transformation, as well as by mixing processes. Author

N71-13542# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
20 Nov. 1970 13 p refs Transl. into ENGLISH from Dokl. Aksd. Nauk SSSR (Moscow), no. 2, 1970 p 280–287
(JPRS-51830) Avail: NTIS

CONTENTS:

1. THEORY OF NONSTATIONARY AUTOMATIC CONTROL SYSTEMS K. A. Abgaryan p 1–6 refs (See N71-13543 04-10)

2. GENERAL METHOD OF CONSTRUCTING ASYMMETRICAL CODING SYSTEMS CONNECTED WITH THE SOLUTION OF THE COMBINATORY DIXON PROBLEM R. Varshamov p 7–12 refs (See N71-13544 04-10)

N71-13543# Joint Publications Research Service, Washington, D.C.
THEORY OF NONSTATIONARY AUTOMATIC CONTROL SYSTEMS
K. A. Abgaryan *In its* Cybernetics and Regulation Theory 20 Nov. 1970 p 1–6 refs (See N71-13542 04-10)
Avail: NTIS

The method of constructing the solutions of the given system in the form of an asymptotic series is indicated, and the approximate criteria of the so-called 'local stability' of the unperturbed motion are formulated. The problem is discussed with respect to control systems in which the effect of the regulator on the controllable process is low so that the solutions of the equations of the closed system are close to the solutions of the equations of the corresponding to stationary servomechanisms. Author

N71-13544# Joint Publications Research Service, Washington, D.C.
GENERAL METHOD OF CONSTRUCTING ASYMMETRICAL CODING SYSTEMS CONNECTED WITH THE SOLUTION OF THE COMBINATORY DIXON PROBLEM
R. R. Varshamov *In its* Cybernetics and Regulation Theory 20 Nov. 1970 p 7–12 refs (See N71-13542 04-10)
Avail: NTIS

The problem of synthesizing coding systems with asymmetrical channel distortions is considered. A general method is proposed for constructing efficient coding systems correcting any given number of asymmetrical errors in advance, which is connected with solving one of the problems of additive number theory. Author

N71-13545* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATIC BALANCING DEVICE Patent
Norman M. Hatcher and Richard N. Young, inventors (to NASA) Issued 20 Oct. 1970 (Filed 27 Feb. 1969) 5 p Cl. 73-1; Int. Cl. G01p21/00
(NASA-Case-LAR-10774; US-Patent-3,534,584; US-Patent-Appl-SN-802820) Avail: US Patent Office CSCL 09C

An automatic balancing device for use on frictionlessly supported attitude-controlled test platforms is considered. This device has fast response, a high degree of accuracy and reliability, compatibility with all vehicular torquing systems, and ability to operate within a wide range of imbalances. It also has low weight, volume, and power consumption. A block diagram of the device and a schematic of the electronic circuitry used are included. E.M.C.

N71-13546# Lyon Univ. (France). Inst. de Physique Nucleaire.
THEORETICAL AND EXPERIMENTAL STUDIES ON THE TIME RESOLUTION OF Ge(Li) DETECTORS [ETUDE THEORIQUE ET EXPERIMENTALE DE LA RESOLUTION EN TEMPS DES DETECTEURS Ge(Li)]
Jean-Claude Balland (Ph.D. Thesis)
(LYCEN-7023) Avail: AEC Depository Libraries

The problem of the extraction of the temporal information contained in a signal from a Ge(Li) junction was studied. A statistical estimation method was used, which allowed the lower limit of the variance of the estimated signal arrival time to be defined. The statistical properties of the detector electronic system were then studied. It was possible to simulate experiments which were very difficult or impossible to perform in practice; in particular the influence of several filters on the performance of the system was investigated. The electronic system and the results attainable are described. NSA

N71-13900*# Radiation, Inc., Melbourne, Fla. Systems Div.
STUDY OF TECHNIQUES FOR REDUNDANCY VERIFICATION WITHOUT DISRUPTING SYSTEMS
Sep. 1970 275 p refs
(Contract NAS10-7072)
(NASA-CR-111785; TR-1087) Avail: NTIS CSCL 09C

The problem of verifying the operational integrity of redundant equipment and the impact of a requirement for verification on such equipment is considered. Redundant circuits are examined and the characteristics which determine adaptability to verification are identified. Mutually exclusive and exhaustive categories for verification approaches are established. The range of applicability of these techniques is defined in terms of signal characteristics and redundancy features. Verification approaches are discussed and a

methodology for the design of redundancy verification is developed. Design criteria for redundant equipment are presented. The criteria assure adaptability of the equipment to automated verification. Recommendations for the development of technological areas pertinent to the goal of increased verification capabilities are given.
Author

N71-13921# Hazeltine Corp., Little Neck, N.Y.
LOW DISTORTION DISPERSIVE NETWORKS FOR WIDEBAND SIGNAL PROCESSING SYSTEMS
F. G. Herring, P. M. Krencik, and A. J. Axel *In* AGARD Advanced Radar Systems Nov. 1970 27 p refs (See N71-13901 04-07)
Avail: NTIS

Described are the synthesis, design, and implementation of wideband, low distortion, lumped and distributed constant, dispersive networks. These networks are important in modern signal processing systems to implement (radar) pulse expansion and compression, instantaneous spectrum analysis (real-time Fourier transformer), antenna beam steering and electronically variable delays. Three types of dispersive networks are described. Each type was developed to satisfy an operational requirement; together, the three types permit the realization of a wide range of dispersive characteristics. Measured amplitude and phase data are presented for each type, and oscilloscope photographs are shown which demonstrate the network performance in a (pulse compression) system application.
Author

N71-13922# Compagnie Generale de Telegraphie Sans Fil, Paris (France).
DIGITAL CORRELATION [CORRELATION DIGITALE]
R. Carre *In* AGARD Advanced Radar Systems Nov. 1970 11 p In FRENCH (See N71-13901 04-07)
Avail: NTIS

This study contains theoretical and numerical control simulations of correlation techniques that are important for detecting weak signals in interference noise found in radar-, sonar-, and code transmissions. A procedure is developed that replaces the continuous modulation function with a phase quantifying function by using digital methods to realize the correlation function. The projected variability of the emission codes preserves closely the ambiguity function during continuous modulation. The developed method is applicable to all forms of frequency or phase modulation.
Transl. by G.G.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-13548# Centre d'Etudes et de Recherches d'Anthropologie Appliquee, Paris.
FORECASTING NOISE ANNOYANCE AROUND AIRPORTS AND PERSPECTIVE REMEDIES [PREVISION DE LA GENE DUE AU BRUIT AUTOUR DES AEROPORTS ET PERSPECTIVES SUR LES MOYENS D'Y REMEDIER]
Ariel Alexandre Apr. 1970 157 p refs In FRENCH
(Doc-A-A-29/70) Avail: NTIS

The physical characteristics of airport noise and its effects on man are reported. A comparison is made of noise in several international airports and of four airports in France. Recommendations for noise reduction and the progress made in reducing noise levels are reported. An extensive bibliography is included.
Transl. by E.H.W.

N71-13576# Advisory Group for Aerospace Research and Development, Paris (France).
BALLISTIC RANGE TECHNOLOGY
Thomas N. Canning, Alvin Seiff, and Carlton S. James, eds. (NASA. Ames Res. Center) Aug. 1970 483 p refs Prepared by NASA. Ames Res. Center and the Defence Res. Estab., Valcartier, Quebec (AGARDograph-138; AGARD-AG-138-70) Avail: NTIS

CONTENTS:

1. MODERN BALLISTIC RANGES AND THEIR USES T. N. Canning and A. Seiff (NASA. Ames Res. Center, Moffett Field, Calif.) p 1–8 (See N71-13577 04-11)

2. THE LIGHT-GAS-GUN MODEL LAUNCHER R. E. Berggren and R. M. Reynolds (NASA. Ames Res. Center, Moffett Field, Calif.) p 9–96 refs (See N71-13578 04-11)

3. MODEL AND SABOT DESIGN AND LAUNCHING TECHNIQUES C. E. De Rose and P. F. Intrieri (NASA. Ames Res. Center, Moffett Field, Calif.) p 97–154 refs (See N71-13579 04-11)

4. TERMINAL BALLISTICS J. L. Summers and B. P. Denardo (NASA. Ames Res. Center, Moffett Field, Calif.) p 155–166 refs (See N71-13580 04-11)

5. COUNTERFLOW FACILITIES R. J. Carros and C. E. De Rose (NASA. Ames Res. Center, Moffett Field, Calif.) p 167–196 refs (See N71-13581 04-11)

6. SYSTEMS FOR MEASUREMENT OF MODEL POSITION, ATTITUDE, AND VELOCITY C. S. James, R. J. Carros, A. G. Boissevain, R. I. Sammonds, and M. E. Wilkins (NASA. Ames Res. Center, Moffett Field, Calif.) p 197–266 refs (See N71-13582 04-14)

7. AERODYNAMICS OF BODIES FROM MOTION ANALYSIS G. T. Chapman, D. B. Kirk, and G. N. Malcolm (NASA. Ames Res. Center, Moffett Field, Calif.) p 267–348 refs (See N71-13583 04-01)

8. SHADOW, SCHLIEREN, AND INTERFEROMETER PHOTOGRAPHS AND THEIR USE IN BALLISTIC RANGES A. Seiff (NASA. Ames Res. Center, Moffett Field, Calif.) p 349–398 refs (See N71-13584 04-14)

9. TECHNIQUES FOR OPTICAL RADIATION STUDIES IN THE BALLISTIC RANGE W. A. Page (NASA. Ames Res. Center, Moffett Field, Calif.) p 399–424 refs (See N71-13585 04-14)

10. MICROWAVE STUDIES M. Gravel, D. Heckman, and R. Tremblay (CARDE) p 425–466 refs (See N71-13586 04-14)

11. POINT MEASUREMENT IN THE WAKE L. Tardif, C. La Haye, D. Heckman, D. Ellington, and J. G. G. Dionne (CARDE) p 467–486 refs (See N71-13587 04-14)

12. CONVECTIVE HEATING MEASUREMENTS G. T. Chapman, L. Yee, D. L. Compton, and M. E. Wilkins (NASA. Ames Res. Center, Moffett Field, Calif.) p 487–508 refs (See N71-13588 04-14)

N71-13577*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODERN BALLISTIC RANGES AND THEIR USES
Thomas N. Canning and Alvin Seiff *In* AGARD Ballistic Range Technol. Aug. 1970 p 1–8 (See N71-13576 04-11)
(NASA-TM-X-66530) Avail: NTIS CSCL 14B

Features of modern ballistic ranges and the kinds of research done in them are reviewed. Briefly discussed are: light gas guns; design and construction of sabot models; photographic stations and flow photography; motion analysis; modifications of the test environment; and special measurement techniques. Also included is a brief listing of Western Europe and North American laboratories in which light gas guns are used.
A.L.

N71-13578*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE LIGHT-GAS-GUN MODEL LAUNCHER
Robert E. Berggren and Robert M. Reynolds *In* AGARD Ballistic Range Technol. Aug. 1970 p 9–96 refs (See N71-13576 04-11)
(NASA-TM-X-66531) Avail: NTIS CSCL 14B

The history of the development and usage of the light gas gun in ballistic range research are briefly reviewed. Major emphasis is on the design, characteristics, and operation of the two stage gun now in wide use as a laboratory model launcher. A.L.

N71-13579*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODEL AND SABOT DESIGN AND LAUNCHING TECHNIQUES
Charles E. De Rose and Peter F. Intrieri *In* AGARD Ballistic Range Technol. Aug. 1970 p 97–154 refs (See N71-13576 04-11)
(NASA-TM-X-66532) Avail: NTIS CSCL 14B

Some of the basic principles of model and sabot design are discussed and typical examples of successful designs are analyzed. A.L.

N71-13580*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
TERMINAL BALLISTICS
James L. Summers and B. Pat Denardo *In* AGARD Ballistic Range Technol. Aug. 1970 p 155–166 refs (See N71-13576 04-11)
(NASA-TM-X-66533) Avail: NTIS CSCL 14B

Techniques which are special to the performance of impact studies in ballistic ranges are discussed. Various arrangements of the basic equipment essential to doing impact work in these ranges are also described. A.L.

N71-13581*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COUNTERFLOW FACILITIES
Robert J. Carros and Charles E. De Rose *In* AGARD Ballistic Range Technol. Aug. 1970 p 167–196 refs (See N71-13576 04-11)
(NASA-TM-X-66534) Avail: NTIS CSCL 14B

To meet the demands for higher velocities in aerodynamics studies, a counterflow facility is used. This facility consists of a long test section in which a supersonic airstream of near constant stream properties is established. With this facility the airstream velocity is added directly to the model velocity. The operating parameters and inherent problems involved with operating a counterflow facility are discussed. The two types of facilities investigated are the continuous flow and short duration. A.L.

N71-13695*# East-West Gateway Coordinating Council, East St. Louis, Ill.
AN ANALYSIS OF AIRPORT TRAVEL DEMANDS, LAMBERT-ST. LOUIS MUNICIPAL AIRPORT
Oct. 1969 78 p Prepared in part by Voorhees (Alan M.) and Assoc., Inc., and Crawford, Bunte, Roden, Inc.
(PB-192057) Avail: NTIS CSCL 15E

A study is reported of the impact that 1990 air travel demands will have on vehicular traffic in the St. Louis Bi-State Metropolitan Area. Two surveys were conducted at Lambert-St. Louis Municipal Airport. One evaluated present airline passenger characteristics and the other dealt with the air cargo industry. The survey data provided a base for projecting future airline travel. Author (USGRDR)

N71-13776*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A CHRONOLOGY OF THE GEORGE C. MARSHALL SPACE FLIGHT CENTER FROM 1 JANUARY–31 DECEMBER 1967
A. Ruth Jarrell, comp. Apr. 1970 205 p refs
(NASA-TM-X-66540; MHR-7) Avail: NTIS CSCL 14B

A chronology of noteworthy events at the George C. Marshall Space Flight Center and its related government and contractor organizations is presented. The chronology covers the period January 1 to December 31, 1967 and relates the most important activities in support of NASA. The principal mission in 1967 was to develop launch vehicles for advanced space exploration. The immediate objective was to provide the Saturn vehicles for the manned lunar landing. Author

N71-13777# Federal Aviation Administration, Washington, D. C. Eastern Region Airport Development Task Force.
AIRPORT DEVELOPMENT TASK FORCE Progress Report
Sep. 1970 59 p
(PR-3) Avail: NTIS

The activities of the Eastern Region Airport Development Task Force are reported. A complete analysis of the demands on the New York metropolitan airport system, the expected growth factors for the area as related to national forecasts, and an appraisal of the capacities of the existing airport facilities, as well as the application of any theoretical improvements to these facilities that could be considered are presented. Specific findings which may be technically feasible to implement, and which are compatible with community need and designed to meet forecast growth are discussed. Author

N71-13778# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DESIGN AND OPERATION OF THE IMPERIAL COLLEGE NO. 2 HYPERSONIC GUN TUNNEL
D. A. Needham, G. M. Elfstrom, and J. L. Stollery May 1970 48 p refs
(IC/70/04) Avail: NTIS

The design considerations and operating performance of a hypersonic gun tunnel are presented. Subjects discussed are: (1) component design, (2) gas services, (3) instrumentation, (4) calibration, and (5) tunnel performance. Author

N71-13782# European Organization for Nuclear Research, Geneva (Switzerland).
DESIGN STUDIES FOR A LARGE PROTON SYNCHROTRON AND ITS LABORATORY
J. B. Adams and E. J. N. Wilson 28 Feb. 1970 57 p refs
(CERN-70-6) Avail: AEC Depository Libraries

A study is presented in which an attempt has been made, using the experience of CERN, Meyrin and that of other similar laboratories, to establish guidelines for the proposed new CERN laboratory and for its principal research tool, a large proton synchrotron. From these generalities, some design requirements have been put forward for the accelerator which have led to specific designs for three different types of machines called the fixed-energy machine, the missing-power machine, and the missing-magnet machine. The options for future development of the laboratory opened up by the different types of machines are discussed, and their costs compared. Finally, other design considerations arising from the need for flexibility for future development are discussed. NSA

N71-13784# European Organization for Nuclear Research, Geneva (Switzerland).
RADIAL AND PHASE BEAM POSITIONING DEVICE FOR

70-GeV SYNCHROTRON
S. V. Chirkov [1969] 7 p Transl. into ENGLISH from Russian Report No. NTD-6824 Revised
(CERN-Trans-69-34; NTD-6824-Rev) Avail: AEC Depository Libraries

The operation of an automatic system for controlling the radial position of the center of gravity of the beam and the phase of the beam in a 70-GeV synchrotron is briefly described. NSA

N71-13801# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ELECTRICAL STUDY OF PULVERIZED PLATINUM THIN FILMS, AND APPLICATION TO THERMAL FLUXMETERS [ETUDE ELECTRIQUE DES COUCHES MINCES DE PLATINE PULVERISE, AVEC APPLICATION AUX FLUXMETRES THERMIQUES]
Michele Nicolas (Ph.D. Thesis—Paris Univ.) 1970 57 p refs In FRENCH; ENGLISH summary
(ONERA-NT-168) Avail: NTIS

A series of tests were performed on the reproducible manufacture and electrical properties (resistivity, temperature coefficient) of the thermosensitive part of a surface temperature fluxmeter. In addition the deposit thickness, and the resistivity and temperature coefficient of the massive metal having the same structure as the thin film were studied. Author (ESRO)

N71-13802# Physics International Co., San Leandro, Calif.
A SUMMARY OF THE DEVELOPMENT OF LARGE EXPLOSIVE GUNS FOR REENTRY SIMULATION
J. D. Watson Aug. 1970 149 p refs
(Contract DA-04-200-AMC-796(X); ARPA Order 546)
(AD-712394; PIFR-155) Avail: NTIS CSCL 14/2

The results are described of a program to develop an explosive gun capable of launching large saboted models to reentry velocities. A secondary objective was to accelerate small projectiles to the highest possible velocity. Saboted lithium-magnesium models up to 4.5 inch diameter were launched successfully to 4.8 km/sec. Attempts to accelerate 6-inch-diameter and 7.3-inch-diameter models were not completely successful. A velocity-mass record was achieved by accelerating a 2-gram cylindrical projectile to 12.2 km/sec. Author (USGRDR)

N71-13803# South Alabama Regional Planning Commission, Mobile.
UPPER GULF COAST REGIONAL AIR TRANSPORTATION STUDY. VOLUME 1
Apr. 1970 186 p refs Prepared in cooperation with Speas (R. Dixon) Associates, Inc., Atlanta
(PB-194339) Avail: NTIS CSCL 01B

Existing facilities inventory and analysis, capacity analyses of existing facilities, airspace and air traffic inventory and analysis, and forecasts of air carrier and general aviation activity in five year increments through the year 1995 are presented. Also included in the report are results of an air carrier passenger local trip origin survey. Author (USGRDR)

N71-13804# South Alabama Regional Planning Commission, Mobile.
UPPER GULF COAST REGIONAL AIR TRANSPORTATION STUDY. VOLUME 2
Jul. 1970 230 p Prepared in cooperation with Speas (R. Dixon) Associates, Inc., Atlanta
(PB-194340) Avail: NTIS CSCL 01B

Air transportation system-wide alternatives available and the major areas of airspace conflict are identified. The recommended plan provides for the overall system of airports as well as identifying the role of each airport in the overall system. New airports are recommended as reliever airports and to serve areas now remote from air service. The critical aircraft and airport development necessary to provide sufficient capacity for the expanded demand along with general funding requirements are indicated for each airport through 1995. Author (USGRDR)

N71-13805# European Organization for Nuclear Research, Geneva (Switzerland).
ELECTROSTATIC INJECTOR OF A SMALL-APERTURE ACCELERATOR
A. A. Vasilev, G. I. Batskikh, and G. I. Klenov [1969] 10 p Transl. into ENGLISH from Russian Report No. NTD-6819 Revised
(CERN-Trans-69-35; NTD-6819-Rev) Avail: AEC Depository Libraries

The main parameters of the Van de Graaff beam injector for the prototype cybernetic accelerator are briefly discussed. The high frequency ion source, focusing lenses, and stabilization system are described. Author (NSA)

N71-13806# Japan Atomic Energy Research Inst., Takasaki. Radiation Chemistry Research Establishment.
THE 3 MeV 15 kW ELECTRON BEAM GENERATOR AT TAKASAKI RESEARCH ESTABLISHMENT
Yunosuke Oshima, Keiichi Yotsumoto, Ryuichi Tanaka, Satoshi Tajima, and Hiromi Sunaga Jul. 1970 29 p refs In JAPANESE; ENGLISH summary
(JAERI-1190) Avail: AEC Depository Libraries

The characteristics of an electron accelerator are presented. The accelerator has the maximum output of 3 MV in accelerating voltage and of 5 mA in electron beam current, and continuous rating of 2.5 MV and of 4 mA. The cascade generator circuit of the accelerator is of the symmetrical inverse type using selenium rectifiers operating at a frequency of 10 kHz. The voltage drop and the capacitative input impedance of the generator due to stray capacitance are compensated by coils inserted into the circuit at intervals of 5-stages. The 120-stage accelerating tube is made of overlapped micro-metal electrodes for shielding the external field. The accelerated electron beam is scanned in the width of 60 cm, and emitted into the atmosphere from a scanning window which is made of 200 micrometers thick aluminum foil. Author (NSA)

N71-13822# Brookhaven National Lab., Upton, N.Y.
R20 VARIABLE APERTURE COLLIMATOR MECHANICAL CONSTRUCTION AND MANUAL CONTROL
L. E. Repeta and J. A. Curtiss 2 Jun. 1970 28 p refs Sponsored by AEC
(BNL-14808) Avail: NTIS

The design of an adjustable four-jaw collimator for slow beam extraction is given. Equipment for remote manual control and position readout is described. Author (NSA)

N71-13823# Centro Informazioni Studi Esperienze, Milan (Italy).
PROJECT OF A 8 MeV TANDEM VAN de GRAFF. PART 2: TERMINAL STABILIZATION
E. Caruso, G. Giorgetti, and M. Milazzo Mar. 1970 51 p refs
(CISE-N-136) Avail: AEC Depository Libraries

A terminal voltage stabilization system for an 8 MeV tandem Van de Graaff accelerator is described. The accelerator is equipped with a 90 deg analyzing magnet which directs the beam through a narrow slit. If the beam energy changes, a signal is obtained from a differential amplifier connected to the slit and used to stabilize the terminal voltage. Author (NSA)

N71-14487*# Michigan Univ., Ann Arbor. Willow Run Labs.
MAINTENANCE AND OPERATION OF THE MULTISPECTRAL DATA COLLECTION AND REPRODUCTION FACILITIES OF THE UNIVERSITY OF MICHIGAN

Philip G. Hasell, Jr. Mar. 1970 28 p refs
(Contract NAS9-9304)
(NASA-CR-108717; WRL-2599-11-P) Avail: NTIS CSCL 14B

The airborne multispectral data collection system was maintained in a state of operational readiness and accomplished twenty missions during 1969. Unsuitable weather at the site caused the cancellation of one mission. Over 100,000 ground track miles of scanner imagery in ultraviolet, visible, and infrared wavelengths were recorded on magnetic tape with about one third reproduced on film for visual analysis. All tape-recorded scanner data is available on duplicate magnetic tapes in analog form suitable for machine processing. Scanner boresight aerial photography was obtained simultaneously in various film/filter combinations at all sites. Author

N71-14494# East Central Florida Regional Planning Council, Titusville.
GENERAL AVIATION AIRPORT SYSTEM
Feb. 1970 78 p refs Prepared by Orange-Seminole-Osceola Planning Comm. for East Central Fla. Regional Planning Council
(PB-191239) Avail: NTIS CSCL 05A

An inventory of existing airports in Orange, Seminole, and Osceola is presented. Data on aviation activity trends, land use patterns, highway access, aircraft owners, finance, organization and tourism are shown. Standards for general aviation airport planning are developed and used for system analysis and evaluation. Recommendations are presented concerning a plan for general aviation airports, staged construction, organization and finance, and proposed land use near three airports. Author (USGRDR)

N71-14495# Los Alamos Scientific Lab., N.Mex.
TARGET-DESIGN AND DATA-REDUCTION CODES FOR THE ARLG GUN
J. N. Fritz and J. A. Morgan Jun. 1970 30 p
(Contract W-7405-eng-36)
(LA-4481) Avail: NTIS

A compact pin array which has the capability of measuring the tilt in a shock wave produced in a high velocity impact, as well as the shock wave velocity is described. Some considerations on the design of targets for high pressure impacts are given. Computer codes for performing numerical analysis are presented. Author

N71-14496# Sandia Corp., Albuquerque, N.Mex.
GRADIENT SHOCK TUBES WITH STRONG INCIDENT SHOCK WAVES IN HYDROGEN
D. A. Freiwald Aug. 1970 40 p refs Sponsored by AEC
(SC-RR-70-537) Avail: NTIS

In a gradient shock tube a strong incident shock wave propagates through a density gradient whose density decreases in the direction of shock wave propagation. Among other things the shock-gradient interaction results in shocked gas acceleration. If the density into which the shock propagates is sufficiently high an enhanced transmitted shock "breaks out" of the gradient. If the density ahead of the shock is too low the shock degenerates and the flow evolves into a high speed free expansion. Gradient shock tube theory is presented for real gas hydrogen (thermophysical properties). The theory is compared to results of experiments which employed shock tubes with high explosive drivers and bursting of a diaphragm prior to shock wave arrival to establish a gradient. Author

N71-14497# Sandia Corp., Albuquerque, N.Mex.
SANDIA 500-KILOJOULE ARC-DRIVEN SHOCK TUBE FACILITY
A. J. Mulac, J. L. Mark, and J. A. Guzman Jun. 1970 45 p refs Sponsored by AEC
(SC-DR-70-217) Avail: NTIS

The physical characteristics and basic instrumentation of an arc-driven shock tube facility are presented. The shock tube provides a facility for the study of shock wave physics and chemical kinetics pertinent to reentry problems. Author

N71-14498# Institute of Nuclear Research, Warsaw (Poland).
THE 10-MeV PROTON LINEAR ACCELERATOR [LINIOWY AKCELERATOR PROTONOW 10 MEV]
Praca Zespolowa 1970 68 p refs In POLISH; ENGLISH summary
(INR-1187) Avail: AEC Depository Libraries

Principles of operation and main technical data of a proton linear accelerator are given. All basic problems of design, construction and start-up of the machine are described. Author (NSA)

N71-14499# California Univ., Livermore. Lawrence Radiation Lab.
CARBON ADSORBER FIRE EXSTINGUISHMENT TESTS
J. L. Murrow 14 Jul. 1970 9 p Presented at 11th AEC Air Cleaning Conf., Richland, Wash., 31 Aug.–3 Sep. 1970 Sponsored by AEC
(UCRL-72496; CONF-700816-1) Avail: NTIS

Activated-carbon adsorbers in air-cleaning systems should be protected from fire. However, as they can ignite under unusual conditions, an adequate exstinguishing system should be installed ready for use. Available systems are examined. The Savannah River-style cell (24 × 24 × 12 inches), containing approximately 60 pounds of 6-14 mesh carbon, was used for these tests. Single-head spray nozzles and arrays delivering up to 36 gallons per minute (gpm) at operating pressures to 150 psig, with patterns from fog to solid cone were tried using plain water and water with wetting agent. Under the conditions of this test, water sprays did not extinguish the fire as long as air continued to flow. Liquid nitrogen was used successfully as an exstinguishing agent under the same conditions. The rate of application to a single adsorber was 20 liters per minute for seven minutes. Author (NSA)

N71-14500# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
THE DESIGN AND IMPLEMENTATION OF A REGENERATIVE BEAM EXTRACTOR FOR THE 110 INCH HARWELL SYNCHROCYCLOTRON
D. West Jul. 1970 42 p refs
(AERE-R-6353) Avail: AEC Depository Libraries

Extensive use was made of orbit computer programs, in conjunction with magnetic field surveys, both in the design and installation stages of the work. An extracted beam of 50 nanoamperes (3.7 × 10 to the 11th power protons per sec.) at an energy of 159 MeV was obtained from an internal beam of 2 microamperes. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-13688# Michigan Univ., Ann Arbor. Dept. of Naval Architecture and Marine Engineering.
SINGULAR PERTURBATION PROBLEMS IN SHIP HYDRODYNAMICS
T. Francis Ogilvie Oct. 1970 204 p refs
(Grant NSF GK-14378)
(Rept-98) Avail: Issuing Activity

A survey was conducted of a group of ship hydrodynamics problems that have certain solution methods in common. The

problems are all formulated as perturbation problems, that is, the phenomena under study involve small disturbances from a basic state that can be described adequately without any special difficulties. The methods of solution make explicit use of the fact that the disturbances of the basic state are small. Mathematically, this is formalized by the introduction of one or more small parameters which serve as measures of the smallness of various quantities. The solutions obtained will generally be more nearly valid for small values of the parameters. However, the problems are also characterized by the fact that they are ill-posed in the limit as the small parameters approaches zero. Thus, they are termed singular perturbation problems. Author

N71-13763*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A COMPARISON OF SPHERICAL AND TRIANGULAR BOUNDARY-LAYER TRIPS ON A FLAT PLATE AT SUPERSONIC SPEEDS

Raymond M. Hicks and William R. Harper, Jr. Washington Dec. 1970 39 p refs

(NASA-TM-X-2146; A-3722) Avail: NTIS CSCL 20D

An experimental investigation was conducted in the Ames 1- by 3-foot supersonic wind tunnel using spherical and triangular protuberances to promote artificial boundary layer transition from laminar to turbulent flow on a flat plate. The location of the trips varied from 0.08 in to 1.0 in from the leading edge. The free stream Mach numbers of the test were 1.58, 2.17, and 2.91. At Mach numbers of 1.58 and 2.17, the spherical trips had a nominal diameter of 0.01 in while the triangular trips had a height of 0.0073 in. At a Mach number of 2.91, 0.015 in (nom.) diameter spheres and 0.0146 in high triangles were used. The relative effect of the spherical and triangular trips was studied by varying unit Reynolds number over a range at each Mach number. The sublimation technique was used exclusively in the investigation to determine the location of transition. Author

N71-13766# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

AN INVESTIGATION OF A SUPERSONIC SURFACE JET-HYPERSONIC FLOW INTERACTION WITH AXIAL SYMMETRY

Raymond P. Shreeve Sep. 1970 149 p refs

(D1-82-0999) Avail: NTIS

The complex interaction between a supersonic air jet from a slot with a hypersonic flow of air over a surface was investigated experimentally. The conditions were such that the boundary layer was fully turbulent and both injectant and free stream, at different temperatures, could be considered to be perfect gases. The design of the experiment followed a consideration of the governing non-dimensional groups. From physical arguments, the parameters considered to control major changes in the interaction structure, the angle of the jet to the surface, and the jet to free stream pressure ratio, were selected for study. The experiment was carried out at Mach 6 using a 5 deg cone with a circumferential slot. Optical observations were made and surface pressures were measured. Impact pressure and stagnation temperature surveys were recorded and reduced to obtain mass flux and other flow profiles using digital computer techniques. Author

N71-13767*# Scripta Technica, Inc., Washington, D.C.

FUNDAMENTALS OF THE THEORY OF TURBINES OPERATING ON WET STEAM

I. I. Kirillov et al NASA Nov. 1970 273 p refs Transl. into ENGLISH of the book "Osnovy Teorii Vlazhnoparovykh Turbin" Leningrad, Mashinostroyeniye, 1968 p 1-259

(Contract NASw-1694)

(NASA-TT-F-611) Avail: NTIS CSCL 20D

The theoretical and experimental condensation processes and gas dynamics of two-phase flows in wet-steam turbines are studied. Problems of gas dynamics are examined as applied to the motion of moisture droplets of various sizes in the flow of steam. Particular attention is paid to clarification of physical phenomena in flow passages of the turbine. The motion of droplet and films are studied for solving practical problems, i.e., determining losses and separation of moisture. Author

N71-13788*# Techtran Corp., Glen Burnie, Md.

USE OF A VORTEX MODEL TO ESTIMATE THE ACCURACY OF A DETERMINATION OF THE TURBULENT CHARACTERISTICS OF SHEAR FLOWS BY THE PHOTOGRAPHIC METHOD [PRIEMENIE VIKHREVOY MODELI DLYA OTSENKI TOCHNOSTI OPREDELENNYA FOTOMETODOM TURBULENTNYKH KHARAKTERISTIK V POTOKAKH SO SDVIGOM]

E. V. Zalutskiy Washington NASA Jul. 1970 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Tekh. Nauk (USSR), Oct. 1969 p 12-16

(Contract NASw-2037)

(NASA-TT-F-13133) Avail: NTIS CSCL 20D

The accuracy of a determination of the kinematic characteristics of turbulent flows by means of flow visualization and photography is studied. In order to obtain, in a simplified form, the relation between the kinematic characteristics of a turbulent flow and the frequency fluctuations of the velocity, it is recommended that the flow velocity structure be represented in the form of an ensemble of plane vortices differing in intensity and configuration and moving with a certain averaged velocity relative to the investigated point. Author

N71-13769*# General Applied Science Labs., Inc., Westbury, N.Y.

AN INVESTIGATION OF THE HIGH SPEED TURBULENT BOUNDARY LAYER WITH HEAT TRANSFER AND ARBITRARY PRESSURE GRADIENT. PART 1: Summary Report

Constantino Economos and John Boccio Washington NASA Dec. 1970 118 p refs

(Contract NAS1-8424)

(NASA-CR-1679; GASL-TR-719-Pt-1) Avail: NTIS CSCL 20D

The behavior of high-speed turbulent boundary layers under conditions involving both heat transfer and arbitrary streamwise pressure gradient is analyzed. The approach utilizes a compressibility transformation in conjunction with an integral technique to describe the fluid-dynamic behavior. The corresponding thermodynamic behavior is described by implicit-finite difference solution of the energy conservation equation written in terms of total enthalpy. One feature of the analyses involves the use of certain correlative procedures developed in this report. The properties of the transformation theory were reexamined from a fundamental level with the aim of overcoming some of its shortcomings and enlarging its applicability to include the more general problem treated. The details of the numerical and computational procedures utilized to implement the analysis are presented. A variety of numerical results are presented in this document. These include comparisons with other predictive methods and with experimental data. Additional results showing eddy viscosity, shear stress and mixing length distribution in high-speed flows are also presented. Author

N71-13770*# Techtran Corp., Glen Burnie, Md.

INVESTIGATION OF TWO-LAYER GAS FLOWS IN SUPERSONIC AXIALLY SYMMETRIC NOZZLES [ISSLEDOVANIE DVUKHSLOYNYKH TECHENIY GAZA V SVERKHZVUKOVYKH OSESIMMETRICHNYKH SOPLAKH]

U. G. Pirumov Washington NASA Jan. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 4, Jul.-Aug. 1970 p 78-81

(Contract NASw-2037)

(NASA-TT-F-13429) Avail: NTIS CSCL 20D

Two methods for computing two-layer flows are described. The first constitutes a generalization of the numerical method,

solution of the inverse problem for the case of two-layer flows without allowance for mixing. The second is the characteristics method for computing two-layer flows in a supersonic nozzle. The ordinary characteristics method is modified in such a way as to allow computation of a point at the discontinuity of layers having different adiabatic indices, different total pressures and temperatures. The results of computations of two-layer flows in nozzles with different adiabatic indices and ratios of outflows of gas in different layers are also given. Author

N71-13790# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

A THEORY OF UNSTEADY COMPRESSIBLE LAMINAR BOUNDARY LAYERS [QUELQUES ASPECTS DE LA THEORIE DES COUCHES LIMITES LAMINAIRES COMPRESSIBLES INSTATIONNAIRES]

Radyadour K. Zeytounian 1970 118 p refs In FRENCH; ENGLISH summary

(ONERA-NT-162) Avail: NTIS

The three-dimensional unsteady compressible laminar boundary layer equations are analysed and the Howarth-Dorodnitsyn-Stewartson transform is generalized to permit use of quasi-incompressible variables. This analysis is applied to the problems of a disk beginning uniform rotation and a flat plate beginning a rectilinear movement, both being initially at rest in zero pressure gradient. It is assumed that all the parameters (assumed known) outside the boundary layer can be expanded in power series of square root of t. The solutions of the two problems were also obtained in similar power series. The solutions obtained, normally valid for small values of time around t = 0, may be used to initiate numerical computations of more complex compressible laminar boundary layers. A detailed study of unsteady convection near an infinite flat plate placed in a gravity field and set at an angle with the horizontal (boundary layer approximation) is also presented. Author (ESRO)

N71-13791# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

THERMAL TRANSPORT COUPLED TO MASS TRANSPORT IN A LAMINAR FLOW IN A TUBE AND ON A FLAT PLATE [TRANSPORT THERMIQUE COUPLE AU TRANSPORT DE MASSE DANS UN FLUIDE EN ECOULEMENT LAMINAIRE DANS UN TUBE ET SUR UNE PLAQUE PLANE]

Suzanne Falque and Gerard Lasseu May 1970 44 p refs In FRENCH

(Rept-70-3; Publ-370) Avail: NTIS

The temperature distribution on the internal wall of a tube (external wall at constant temperature) through which a hot gas is flowing is described. If the gas mixture reacts with the wall with the aid of a catalyst, the wall temperature distribution is a function of the catalyst constant and the diffusion coefficient. It is shown that the coupling effect of a catalysed chemical reaction with the laminar flow heat transfer can be computed. Sublimation, evaporation, and condensation effects are also considered. ESRO

N71-13792*# California Inst. of Tech., Pasadena.

THEORETICAL INVESTIGATION OF THE REFLECTION OF IONIZING SHOCKS

A. Crespo-Martinez Paris ESRO Apr. 1969 68 p refs Sponsored in part by NASA, ESRO, and the Comision Nacl. de Invest. del Espacio, Spain

(NASA-CR-115795; ESRO-SN-100) Avail: NTIS CSCL 20D

The reflection of an ionizing shock from the end wall of a shock tube was studied theoretically and agreed with the observed perturbations in the wall pressure history. To describe the first perturbation, a decrease in pressure due to the ionization part in the reflected shock structure, the flow equations were linearized but the rate equations were used in nonlinear form. The second perturbation, an increase in pressure due to the ionization part of the incident shock structure, was studied assuming equilibrium behind the reflected shock. Author (ESRO)

N71-13793*# Techtran Corp., Glen Burnie, Md.

FLUID MECHANICS: DETERMINATION OF THE CHARACTERISTICS OF VORTEX STREETS ASSOCIATED WITH A UNIFORM INITIAL VELOCITY PROFILE [MECANIQUE DES FLUIDES: DETERMINATION DES CARACTERISTIQUES DES RUES DE TOURBILLONS ASSOCIEES A UN JET DE PROFIL DES VITESSES INITIAL UNIFORME]

J. Dat et al Washington NASA Dec. 1970 6 p refs Transl. into ENGLISH from Compt. Rend., Ser. A (France), v. 270, no. 21, 25 May 1970 p 1381–1384

(Contract NASw-2037)

(NASA-TT-F-13395) Avail: NTIS CSCL 20D

The position of consecutive vortices was obtained by both theoretical calculations and by experiments. The variation in the distances between consecutive vortices was also obtained both theoretically and experimentally. Author

N71-13794# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

A SPECIAL SINUSOIDAL SHEAR FLOW OF A DENSITY-STRATIFIED FLUID OVER A TWO-DIMENSIONAL BARRIER

Martha E. Smithmeyer Oct. 1970 31 p refs

(D1-82-1009) Avail: NTIS

Analyses of the two-dimensional steady flow of a density-stratified incompressible fluid over a barrier of nominally semi-circular cross section were extended to include the effect of a special sinusoidal shear superimposed on their essentially uniform upstream flow. The results are presented in the form of streamline contours together with illustrative velocity profiles. Compared to the case with an essentially uniform upstream flow, when the sinusoidal shear decreases the upstream flow near the ground, the amplitudes of the downstream waves decrease; when the shear increases the upstream flow near the ground, the downstream waves are amplified. Author

N71-13795# Imperial College of Science and Technology, London (England). Dept. of Mechanical Engineering.

COMPUTATION OF LAMINAR FLOW BETWEEN SHROUDED ROTATING DISCS

A. D. Gosman and D. B. Spalding Sep. 1970 7 p refs

(EF/TN/A/30) Avail: NTIS

A computer study is described of the flow provoked within a fluid which is confined by spaced, rotating, coaxial discs and a close-fitting, stationary, cylindrical shroud. The flow is presumed to be laminar, steady and axially-symmetrical. The problem is represented mathematically by a set of three simultaneous, elliptic differential equations in vorticity, stream function and swirl velocity. Numerical solutions to this equation set are obtained by application of a general finite-difference solution procedure. The emphasis in the present paper is on the computational aspects of the study. In particular, attention is focussed on problems of numerical instability, which are found to result from the presence of strong swirl-induced sources of vorticity, and also from the inter-linkage between the equations. Author

N71-13800# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

RESULTS OF TRAILING VORTEX STUDIES IN A TOWING TANK

John H. Olsen Sep. 1970 24 p refs

(D1-82-1004) Avail: NTIS

Flow visualization studies were performed in a towing tank using an electrochemically activated dye. Although test Reynolds numbers were far below flight Reynolds numbers (10 to the 4th versus 10 to the 7th power), the results were strikingly similar to flight test data. Two types of instability were observed in the tank. An instability associated with the axial flow within the core was observed to destroy the flow in the neighborhood of the core without destroying the motion far from the core. A second instability involving the mutual interaction of the two vortices was observed but somewhat masked by the first instability. Author

N71-14312# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
TURBULENT PLUME IN A LAMINAR CROSS FLOW
D. P. Hoult and J. C. Weil Oct. 1970 44 p refs
(FML-Publ-70-8) Avail: NTIS

A simple entrainment hypothesis to explain the rise and growth of a turbulent plume in a laminar cross flow is presented. The entrainment rate is assumed proportional to the plume perimeter and the tangential and normal velocity differences between the plume and the surrounding fluid. Because a linear combination of the entrainment due to each velocity difference is assumed, two constants of proportionality or entrainment parameters are introduced in the model. Sources of momentum, buoyancy or combinations of the two are accounted for by the theory. The major effort was on determining the entrainment parameters. Experiments done in neutrally stable ambient fluids show that the entrainment coefficients have universal constant values for a fully turbulent plume and small density differences. Superposition of the two entrainment effects was verified by experiments on pure jets in a cross flow. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-13601# Royal Inst. of Tech., Stockholm (Sweden).
PLASMA FLOW IN THE MAGNETOSPHERE. PART 1: A TWO-DIMENSIONAL MODEL OF STATIONARY FLOW
Erik T. Karlson Sep. 1970 44 p refs
(Rept-70-32-Pt-1) Avail: NTIS

In an inhomogeneous magnetic field there are different forbidden regions for particles of different energies, and also for ions and electrons. The inertia drift is also different for ions and electrons, and gives rise to space charges, so it is necessary to use a self-consistent electric field. This leads to difficult problems for a particle energy distribution so the distribution was simulated by two groups of particles with different energies. When the two groups represent a Maxwellian distribution in the plasma sheet, the forbidden regions are very close, there is no flow inside the Alfven layer and the plasmapause cannot be the outermost closed stream line. There is a continuous transport of terrestrial low energy plasma to the tail and assuming that it is mixed with the higher energy solar wind plasma, one can identify the forbidden region for the latter with the inner edge of the plasma sheet, and the forbidden region for the former with the plasmapause. The electric field in the plasma trough is then much weaker than the field in the plasma sheet. Author (ESRO)

N71-13636# Danish Meteorological Inst., Charlottenlund.
TEMPERATURE COMPENSATION OF FLUXGATE MAGNETOMETERS
F. Primdahl (Dept. of Energy, Mines and Resources) 1970 24 p refs Sponsored by Natl. Res. Council of Can. *Its* Geophys. Papers No. R-17
Avail: NTIS

As the temperature dependence of fluxgate sensors is proportional to the measured field, a temperature compensation circuit was devised using the copper resistance of the fluxgate secondary winding as the thermo-sensitive part of a bridge. The bridge voltage was derived from the magnetometer output so the compensation was only active in high fields. Author (ESRO)

N71-13637# Danish Meteorological Inst., Charlottenlund.
A FERRITE CORE FLUXGATE MAGNETOMETER
F. Primdahl 1970 71 p refs Sponsored by Natl. Res. Council of Can. *Its* Geophys. Papers No. R-12
Avail: NTIS

A fluxgate magnetometer with long-term stability was constructed for standard magnetic observatory work. An orthogonally-gated sensor, with a tubular ferrite core, was used to measure total intensity and was compared with a proton precession magnetometer. Stability tests showed random fluctuations of + or − 3.5 gammas over 60 days. Author (ESRO)

N71-13714# Navy Underwater Sound Lab., New London, Conn.
A COMPARISON OF ELF ATMOSPHERIC NOISE SPECTRA MEASURED ABOVE AND IN THE SEA
Emil F. Soderberg and Manuel Finkle *In* AGARD Electromagnetics of the Sea Nov. 1970 14 p refs (See N71-13701 04-23)
Avail: NTIS

Extremely low frequency (ELF) electromagnetic noise arising from worldwide atmospheric electrical disturbances was measured at sea, using a ship-mounted whip antenna to sense the vertical electric fields in air and a towed cable with a widely spaced pair of tandem electrodes to sense the corresponding horizontal electric fields in the sea. The outputs of these sensors were recorded simultaneously on multichannel magnetic tape as the ship proceeded on courses of magnetic east and magnetic south. Comparison between the spectra of vertical electric fields in air and horizontal electric fields in the sea shows that the omnidirectionality (in azimuth) of the whip antenna tends to smooth the spectrum whereas the directionality of the electrode pair enhances the spectrum characteristics of sources located in the direction of the electrode pair axis. Author

N71-13715# Paris Univ. (France). Inst. de Physique du Globe.
CHARACTERISTIC NATURAL ELECTROMAGNETIC NOISE LEVELS OF SEA NETS IN THE ULTRALOW FREQUENCY REGION AS FUNCTION OF DEPTH [NIVEAUX CARACTERISTIQUES DU BRUIT ELECTROMAGNETIQUE NATUREL DANS LA GAMME UBF, AU SEIN DES MERS, EN FONCTION DE LA PROFONDEUR]
E. Selzer *In* AGARD Electromagnetics of the Sea Nov. 1970 15 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)
Avail: NTIS

A synthesis is made of the results obtained during successive campaigns on board the Archimedes bathyscaphe combined with those provided by the complete recordings of a magnetic storm by means of a probe immersed at 60 m depth in a bay. Taking account of various hydromagnetic effects related to sea kinetics (waves, currents, etc.), it is shown that real conditions may diverge to a large extent from the theoretical conditions often assumed which take only in consideration the classical skin effect. The overall factors involved are considered in proposing likely thresholds for the natural noise levels that should be expected in sea water within the range of electromagnetic variations considered. Author

N71-13720*# Kansas Univ., Lawrence. Remote Sensing Lab.
WORLDWIDE OCEANIC WIND AND WAVE FORECASTS USING A SATELLITE RADAR-RADIOMETER

Richard K. Moore and Willard J. Pierson (N.Y. Univ.) *In* AGARD Electromagnetics of the Sea Nov. 1970 13 p refs Prepared jointly with N.Y. Univ. (See N71-13701 04-23)
(Contracts NAS9-10261; N62306-67-C-0044; N62306-70-A-0075)
(NASA-CR-115802) Avail: NTIS CSCL 04A

The relationship between radar return from the sea at 2.25 cm wavelength and the speed of the wind disturbing the sea offers an opportunity for a satellite system to provide information for a global wave forecasting system. Comparison of the observations with computations based on application of physical optics to a new composite model of the ocean wave spectrum indicates at least qualitative agreement. The brightness temperature measured by a microwave radiometer looking at the sea is also proportional to wind speed, but the effect of atmospheric attenuation is much greater and is suggested for brightness calibration of the radar scatterometer. An example of the benefits to be gained by using the more plentiful satellite observations of wind speed is presented for the South Atlantic. Because of the sensitivity of both the radar return and the wave spectrum to wind direction, other information, such as that gained from satellite cloud photographs, must be used to perform the forecasts, and the radar data cannot be used alone.
Author

N71-13723# Paris Univ. (France). Lab. d'Oceanographie Physique.
THE EFFECTS OF DISREGARDING DITTMAR'S LAW ON ELECTRICAL CONDUCTIVITY MEASUREMENTS IN SEA WATER [DE L'INFLUENCE DES ECARTS A LA LOI DE DITTMAR SUR LA CONDUCTIVITE ELECTRIQUE DE L'EAU DE MER]
A. Poisson and J. Chanu *In* AGARD Electromagnetics of the Sea Nov. 1970 8 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)
Avail: NTIS

Determining the salinity of seawater samples from conductimetric measurements raises the problem of the contribution of each ionic species present to the overall electric conductivity. Experimental results indicate that this contribution varies appreciably with the nature of the electrolyte, which implies a certain amount of uncertainty regarding the salinity values obtained through routine measurements when Dittmar's law is not strictly checked. The experimental law used leads to determining the partial equivalent conductivity of the main ionic seawater components, even in the case of hydrated or thermally unstable salts.
Author

N71-13732# Centre National pour l'Exploitation des Oceans, Lille (France).
OCEAN SURFACE TEMPERATURE MEASUREMENTS BY MEANS OF INFRARED RADIOMETER [MESURE DE LA TEMPERATURE DE SURFACE DE L'OCEAN AU MOYEN D'UN RADIOMETRE INFRAROUGE]
P. Y. Deschamps, P. Lecomte, and J. C. Vanhoutte *In* AGARD Electromagnetics of the Sea Nov. 1970 17 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)
Avail: NTIS

Within the framework of the general study on the exchanges between the sea and the atmosphere the infrared radiation of the sea has been measured with a radiometer in the 8-14 micron range. Divergences between the radiometric surface temperature and the internal temperature, as measured within the first meter, are revealed. The causes for these divergences are discussed. It is concluded that there exists a cold superficial layer, the temperature of which is at the outside different by 0.3 C from that of the sea mass, in cold and clear weather.
Author

N71-13779# Danish Meteorological Inst., Charlottenlund.
THE POSITION OF THE AURORAL OVAL OVER GREENLAND AND SPITZBERGEN
Knud Lassen 1970 20 p refs Presented at the Skand. Arbejdsgruppe for Rumforskning, SAR, Symp. on ESRO-1A, Kiekkas, Norway, 1 – 4 Apr. 1970 *Its* Geophys. Papers No. R-16
Avail: NTIS

All-sky camera statistics from six Greenland IQSY stations showed night-time and daytime distributions which combined to form the auroral oval. At low K sub p values the distributions were separate but with increasing K sub p they broadened and merged, and the morning peak was displaced towards lower latitudes. The frequency and position of the polar cap aurorae observed from Thule and Vostok were independent of K sub p except in the early afternoon when the frequency decreased with increasing K sub p.
Author (ESRO)

N71-13780# Danish Meteorological Inst., Charlottenlund.
AURORAL HISS AND POLAR MAGNETIC ACTIVITY
T. Stockfleth Jorgensen 1970 35 p refs Presented at the Intern. Symp. on Solar-Terrest. Phys., Leningrad, 11 – 20 May 1970 *Its* Geophys. Papers No. R-13
Avail: NTIS

Auroral hiss and polar magnetic activity relationships were studied by simultaneous ground-based observations at 8 kHz at auroral zone and polar cap stations. It was found that auroral hiss is a daily auroral region phenomenon and substorm activity was not a necessary condition for its generation. It appeared that auroral hiss was produced by plasma sheet electrons and the westward drift of two hiss events indicated that hiss sources are probably convected with the outer magnetospheric plasma.
Author (ESRO)

N71-13781# Institut d'Aeronomie Spatiale de Belgique, Brussels.
PENETRATION OF SOLAR RADIATION IN THE SCHUMANN-RUNGE BANDS OF MOLECULAR OXYGEN
G. Kockarts 1970 34 p refs Presented at the 4th ESRIN-ESLAB Symp., Frascati, Italy, 6 – 10 Jul. 1970 *Its* Aeronomica Acta No. A-78-1970
Avail: NTIS

Molecular oxygen absorption cross-sections, computed at 0.5 per cm wavenumber intervals, were used for studying the absorption of solar radiation in the Schumann-Runge band system. The fine structure of the optical depth was analyzed at different altitudes and for several wavenumber intervals taking into account ozone absorption. The absorption over 500 per cm wavenumber intervals was studied between 2060 A and 1750 A and it is shown that predissociation implies an increase of the total solar flux absorption. Photodissociation coefficients are presented for O2 and for H2O. It was not possible to obtain a unique set of mean absorption cross-sections which could be simultaneously used for the computation of the H2O and O2 photodissociation coefficients.
Author (ESRO)

N71-13782# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
POLAR MAGNETIC SUBSTORMS
Rolf Bostroem Aug. 1970 19 p refs Presented at the Advanced Study Inst. on Aurora and Airglow, Kingston, Ontario, 3 – 14, Aug. 1970
(Rept-70-29) Avail: NTIS

The physical and equivalent current systems of polar magnetic substorms are described along with their ground-level geomagnetic effects. The space charge regions above aurorae and the D, H and Z isointensity contours obtained from a Scandinavian-USSR north-south chain of stations during substorms are discussed.
ESRO

N71-13786# Danish Meteorological Inst., Charlottenlund.
THULE GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS 1962
J. Wilhjelm, K. Frellesvig, and E. Ulander 1970 37 p refs

Avail: NTIS

Tables of the hourly and daily means of the magnetic declination and the horizontal and vertical components of the magnetic intensity recorded at Thule (Greenland) in 1962 are presented along with daily ranges, K and C indices and variometer baseline values. ESRO

N71-13787# Danish Meteorological Inst., Charlottenlund.
RUDE SKOV GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS 1967
Axel Hansen 1970 41 p
Avail: NTIS

Tables of the hourly and daily means of the magnetic declination and the horizontal and vertical components of the magnetic intensity recorded at Rude Skov (Denmark) in 1967 are presented along with daily ranges, K and C indices and variometer baseline values. ESRO

N71-13788# Danish Meteorological Inst., Charlottenlund.
GODHAVN GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS 1964
J. Wilhjelm, K. Frellesvig, and E. Friis-Christensen 1970 60 p refs
Avail: NTIS

Tables of hourly and daily means of the magnetic declination and the horizontal and vertical components of the magnetic intensity recorded at Godhavn (Greenland) in 1964 are presented along with daily ranges, K and C indices and variometer baseline values. ESRO

N71-13824 Pennsylvania State Univ., University Park.
BREMSSTRAHLUNG IN THE LOWER IONOSPHERE
Gustav John Freyer, III (Ph.D. Thesis) 1969 278 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.60 Order No. 70-669

An aeronomic analysis is made of effective bremsstrahlung effects which are due to electrons penetrating into the upper atmosphere in the auroral zone. The electron attenuation in the atmosphere is determined from a Monte Carlo model which includes electron energy loss and scattering processes. A comparison is made between experimental results and the calculated energy deposition rates. Typical electron energy and angular distributions as a function of depth penetration are given. Bremsstrahlung production rate profiles are obtained using the Bethe-Heitler cross sections which include the angular as well as the energy dependence. Numerical calculations are made of the ion production rates for a number of electron precipitation events which were observed. Electron energy distributions are obtained by suitably weighting basic calculations for 5, 10, 15, 25, 35, 50, 70, 100, 150, and 500 keV monoenergetic electrons. The bremsstrahlung ion production rates in the D region are found to be significant primarily for intense fluxes of 1 - 20 keV electrons usually associated with visible aurora. Dissert. Abstr.

N71-13825# Institut d'Aeronomie Spatiale de Belgique, Brussels.
ULTRAVIOLET SOLAR RADIATION RELATED TO MESOSPHERIC PROCESSES
M. Ackerman 1970 25 p refs Presented at the 4th ESRIN-ESLAB Symp., Frascati, Italy, 6-10 Jul. 1970 *Its* Aeronomica Acta No. A-77-1970
Avail: NTIS

The solar ultraviolet radiation involved in the mesospheric processes is subject to atmospheric attenuation at practically all wavelengths so solar fluxes, as well as the absorption cross sections of molecular oxygen and of ozone, are discussed. Author (ESRO)

N71-14436*# Woods Hole Oceanographic Institution, Mass.
BIOLOGICAL OCEANOGRAPHY
Gifford C. Ewing *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1970 p 121-133 (See N71-14426 04-34)
Avail: NTIS CSCL 08A

Biological oceanography and ocean food resource development using satellite observation techniques are discussed. Satellite instrumentation is summarized and properties data are given for water temperature, color, and motion. E.C.

N71-14437*# Stanford Univ., Calif.
REFLECTIONS ON GIFFORD EWING'S PAPER
John V. Breakwell *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 135-136 (See N71-14426 04-34)
Avail: NTIS CSCL 08A

Control theory applications in the field of environmental control are mentioned. E.C.

N71-14443*# Arizona Univ., Tucson.
BANDERA LAVA TUBES OF NEW MEXICO, AND LUNAR IMPLICATIONS
Allen W. Hatheway and Alika K. Herring *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 4 1970 p 299-327 refs (See N71-14439 04-30)
(Grant NGL-020-02-002)
Avail: NTIS CSCL 08G

The morphology and origin of the Bandera lava tubes are considered in genetic relationship to sinuous rilles on the lunar surface. Aerial photographs of the Bandera volcanic field revealed a number of similarities between the lava tubes and lunar rilles and other features. A geologic map covering about 290 sq km, which includes the lava tubes, is appended. E.M.C.

N71-14493# Center for the Environment and Man, Inc., Hartford, Conn.
LONG-TERM EFFECTS OF AIR POLLUTION: A SURVEY
G. D. Robinson Jun. 1970 50 p refs
(Contract PHS-CPA-22-69-155)
(PB-193801; CEM-4029-400; APID-0585) Avail: NTIS CSCL 13B

The need for research into the long term geophysical and biological effects of air pollution is assessed. The problem areas are surveyed and the lines on which useful research could be pursued are broadly delineated. The report contains sections on: the major pollutants, their emission and role in the atmosphere; climate, climatic change, and theories of climate; transport of pollutants in the context of long term effects; pollutants and cloud condensation processes; the biosphere and long term effects of air pollution; and monitoring. Author (USGRDR)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-13582*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
SYSTEMS FOR MEASUREMENT OF MODEL POSITION, ATTITUDE, AND VELOCITY
C. S. James, R. J. Carros, A. G. Boissevain, R. I. Sammonds, and M. E. Wilkins *In* AGARD Ballistic Range Technol. Aug. 1970 p 197-266 refs (See N71-13576 04-11)
(NASA-TM-X-66535) Avail: NTIS CSCL 14B

The data gathering process for many aeroballistic range tests consists of recording the position, attitude, and time of arrival of a model at several accurately surveyed points along its flight path. Most current data gathering systems for documenting projectile motion are fundamentally photographic in concept. The representative optical arrangements and components of the photographic measuring stations are discussed in relation to the environments in which they must function. Also considered are the requirements for extracting the desired numerical data from the exposed photographic film. A.L.

N71-13584*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHADOW, SCHLIEREN, AND INTERFEROMETER PHOTOGRAPHS AND THEIR USE IN BALLISTIC RANGES
Alvin Seiff *In* AGARD Ballistic Range Technol. Aug. 1970 p 349–398 refs (See N71-13576 04-11)
(NASA-TM-X-66537) Avail: NTIS CSCL 14B

The three optical systems normally considered for flow visualization, shadow, schlieren, and interferometers, are discussed and the principles by which flow features are made visible are analyzed. Also discussed are research uses of flow visualization. These may be put into three classes: (1) definition of flow configuration; (2) correlation of flow features with observed aerodynamic and flight behavior; and (3) indirect determination of properties of the flow or flowing gases. A.L.

N71-13585*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
TECHNIQUES FOR OPTICAL RADIATION STUDIES IN THE BALLISTIC RANGE
William A. Page *In* AGARD Ballistic Range Technol. Aug. 1970 p 399–424 refs (See N71-13576 04-11)
Avail: NTIS CSCL 14B

Experimental techniques and the instrumentation developed for radiation studies in ballistic ranges and counterflow facilities are described. At the velocities reached by ballistic range models the temperature of the disturbed flow field is sufficiently high to excite electronic states in the molecules and atoms present. Much of the resultant characteristic photon emission appears in the spectral range amenable to observation and can be used in several important ways: (1) to identify the species present in the shock layer, boundary layer, and wake; (2) to study the basic radiative properties of high temperature gages; (3) to study the ablation of heat shields and the physical-chemical processes in the wakes of entry bodies, and (4) to provide basic data for estimating the radiative heating and entry signatures of entry vehicles. A.L.

N71-13586# Canadian Armament Research and Development Establishment, Valcartier (Quebec).
MICROWAVE STUDIES
M. Gravel, D. Heckman, and R. Tremblay *In* AGARD Ballistic Range Technol. Aug. 1970 p 425–466 refs (See N71-13576 04-11)
Avail: NTIS

The use of microwave techniques in the ballistic range have the notable advantage that no physical disturbance is offered to the flow by microwave probes, and no disturbance of its plasma characteristics is produced by the low intensity microwave radiation which is employed. It is shown that microwave techniques are not only applicable to the study of the hypersonic flow environment, but also have important roles to play in the development of light gas gun launchers. Not all possible applications of microwave technology are discussed, however, emphasis is on those techniques which are, or have been, in routine productive use in ballistic facilities. A.L.

N71-13587# Canadian Armament Research and Development Establishment, Valcartier (Quebec).
POINT MEASUREMENTS IN THE WAKE
L. Tardif, C. La Haye, D. Heckman, D. Ellington, and J. G. G. Dionne *In* AGARD Ballistic Range Technol. Aug. 1970 p 467–486 refs (See N71-13576 04-11)
Avail: NTIS

In studying the detailed structure of wakes, several measurements of wake properties have been tried. The objectives of these measurements were to determine local variations in velocity, temperature, density, and electron population. The four techniques employed were: spark tracing of ionized paths to determine velocity; electrostatic probe measurement of the wake plasma; heat transfer (hot wire or cooled film) anemometry; and electron beam excitation of the flow to determine density from optical radiation emitted. The special features of these techniques for ballistic range studies are noted, and their capabilities and limitations given, consistent with the present state of their development. A.L.

N71-13588*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONVECTIVE HEATING MEASUREMENTS
Gary T. Chapman, Layton Yee, Dale L. Compton, and Max E. Wilkins *In* AGARD Ballistic Range Technol. Aug. 1970 p 487–508 (See N71-13576 04-11) refs
(NASA-TM-X-66539) Avail: NTIS CSCL 20M

Three methods of determining heat transfer rates have been developed for use in ballistic ranges. The three techniques are: (1) passive telemetry system using electromagnetic coupling between two coils; (2) calorimetric measurement of the total aerodynamic heat in the recovered model; and (3) detection of the time of onset of melting of the model. Each of these techniques is basically independent of each other and the inherent advantages and disadvantages of each system are discussed. A.L.

N71-14210# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
OZONE CHEMILUMINESCENT STUDY, PART 1 Final Report
J. B. Tommerdahl Dec. 1969 105 p refs
(Contract PHS-CPA-22-69-7)
(PB-194116) Avail: NTIS CSCL 14B

A comprehensive engineering description of the design, construction details, calibration techniques, and operational characteristics of the ozone meter are reported. A complete set of drawings covering the nonstandard components such as the detector assembly and calibration unit are available. The ozone meters utilize a chemiluminescent disk as the basic sensor. When ozone reacts with certain organic compounds, a minute amount of light is emitted; this light is collected and amplified by a photomultiplier tube. The electrical signal from the PM tube is then a function of the concentration of ozone passing over the chemiluminescent sensor. Author (USGRDR)

N71-14211# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
OZONE CHEMILUMINESCENT STUDY. PART 2: RADIOACTIVE OZONE GENERATOR Final Report
H. G. Richter Feb. 1970 14 p refs
(Contract PHS-CPA-22-69-7)
(PB-194117) Avail: NTIS CSCL 14B

The results of a program to design and construct a prototype ozone generator using an Sr-90 radioisotope as energy source are described. Author (USGRDR)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-13789 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

QUICK RELEASE CONNECTOR Patent

Kennedy F. Rubert, inventor (to NASA) Issued 2 Aug. 1966 (Filed 20 Mar. 1964) 9 p Cl. 102-49

(NASA-Case-XLA-01141; US-Patent-3,263,610; US-PATENT-Appl-SN-353632) Avail: US Patent Office CSCL 13E

The design and development of a quick release connector is discussed. The connector uses tempered glass which has the characteristic of disintegrating into a sand-like material. The remnants of the glass are not sharp or hazardous and produce particles of small volume. The connector provides a frangible system for transferring loads and which will permit complete release at the occurrence of a predetermined event. P.N.F.

N71-14434*# Continental Oil Co., Ponca City, Okla.

CONTROL TECHNOLOGY APPLIED TO PRODUCTION PROBLEMS

C. Vernon Foster *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 99–110 refs (See N71-14426 04-34)

Avail: NTIS CSCL 13H

Automated process control is discussed with emphasis on the oil and chemical industries. Highlighted are the amount of computer control installations in industry, advantages of using computer control, software and hardware problems, chemical process plant design problems, and future prospects for computer process control. E.C.

N71-14435*# Purdue Univ., Lafayette, Ind.

DISCUSSION OF FOSTER PAPER

Theodore J. Williams *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 111-119 (See N71-14426 04-34)

Avail: NTIS CSCL 13H

Standardization of process control software is discussed along with future developments in systems hardware. Tables and charts show: (1) requirements for a standardized set of process control programs, (2) a block diagram of an industrial control program system, (3) hierarchy control in the process industries, (4) a predicted digital process control system, (5) computer systems characteristics for advanced digital process control systems, (6) and cost predictions for such a system. E.C.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-13721# Raytheon Co., Sudbury, Mass.

SEA ECHO AT LASER WAVELENGTHS OF 1.06 MICRONS AND 10.6 MICRONS

A. V. Jelalian and R. G. McManus *In* AGARD Electromagnetics of the Sea Nov. 1970 12 p refs (See N71-13701 04-23)

Avail: NTIS

Discussed are the results of two laser flight test programs conducted over the ocean for the purpose of determining system operation for: (1) a vertically oriented 1.06 micron laser altimeter; and (2) a 10.6 micron optical Doppler radar at a variety of depression angles. The experimental data for a variety of sea states for the vertically oriented altimeter system established that the return signal was definitely range square dependent and that the effective target cross sections were 0.15 and 0.24 for smooth and rough surface water conditions, respectively. The 10.6 micron optical Doppler radar system established that, for a six inch spot size on the ocean surface: (1) the probability of achieving returns decreased as the depression angle decreased; and (2) as the sea state increased the corresponding probability of return increased. Author

N71-13725# Texas Univ., Austin. Antennas and Propagation Lab.

MEASUREMENTS OF THE SPATIAL COHERENCE OF A LASER BEAM PROPAGATING THROUGH WATER

S. G. Varnado and A. H. La Grone *In* AGARD Electromagnetics of the Sea Nov. 1970 10 p refs (See N71-13701 04-23)

Avail: NTIS

Measurements of the spatial coherence of argon laser radiation were performed for one sample of tap water and two samples of natural fresh water. The results indicate that the spatial coherence properties of the laser beam are not significantly degraded by propagation through the water samples considered, at least for propagation path lengths of up to 12.25 attenuation lengths. Author

N71-13831# Compagnie Generale de Telegraphie sans Fil, Orsay (France). Lab. Central Thomson.

STORAGE OF INFORMATION WITH VERY HIGH DENSITY BY HOLOGRAPHIC METHOD [STOCKAGE D'INFORMATION A TRES HAUTE DENSITE PAR METHODE HOLOGRAPHIQUE]

Erich Spitz and Guy Bismuth *In* AGARD Data Handling Devices Nov. 1970 15 p refs In FRENCH (See N71-13826 04-08)

Avail: NTIS

Modern methods store high density information, in reduced volume, in photosensitive layers. Whereas classical methods utilize the first photosensitive layer, the holographic method equally utilizes the thickness of the layer. The three methods used, the direct, the holographic bidimensional and tridimensional, allows enforcement and reininscription of information in silver emulsions and biochromates for easy storage. Examples and applications of document storage are given. Transl. by E.H.W.

N71-14048*# Hayes International Corp., Birmingham, Ala.

DEVELOPMENT TESTING AND APPLICATION OF A THREE-DIMENSIONAL LASER DOPPLER VELOCIMETER FOR THE MEASUREMENT OF GAS FLOWS

C. E. Fuller Apr. 1970 104 p refs

(Contracts NAS8-21527; NAS8-21162)

(NASA-CR-102948; ER-1678) Avail: NTIS CSCL 20E

The work which has been conducted in the development and application of a three-dimensional laser Doppler velocimeter (LDV) system for the measurement of local mean and fluctuating gas velocities with high spatial and temporal resolution is described. This system uses optical instrumentation to remotely gather laser light which has been directed into jet or wind tunnel flows. Optical heterodyning is used to detect the Doppler frequency shift in the laser light which occurs when the light is scattered by small tracer particles within the flow. The LDV system described is capable of simultaneously measuring three Doppler frequency shifts from a given point in a flow field. These three Doppler frequencies along with the angular relation between the system and the flow field are used to determine the velocity magnitude and direction of the tracer particle. Author

N71-14070*# Scientific Translation Service, Santa Barbara, Calif.
SOME PRINCIPLES OF REMOVAL OF MATERIAL FROM METALS UNDER THE ACTION OF LASER RADIATION [NEKOTORYYE ZAKONOMERNOSTI VYKHODA VESHCHESTVA METALLOV PRI VOZDEYSTVII IZLUCHENIYA OKG]
A. I. Korunchikov et al Washington NASA Nov. 1970 10 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 22, no. 5, May 1970 p 819–823
(Contract NASw-2035)
(NASA-TT-F-11912) Avail: NTIS CSCL 20E

The action of laser radiation upon certain metals is investigated. The plasma spectrum, development of the plasma cloud, ejection of plasma streams, and the erosion of the various metals are studied. Author

N71-14071*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.
SEPARATE REFERENCE BEAM HOLOGRAPHIC INTERFEROMETRY AND ITS APPLICATION TO THE MEASUREMENT OF SMALL PHASE VARIATIONS IN SUB-FRINGE SYSTEMS
M. K. Testerman 1 Nov. 1970 55 p refs
(Grant NGL-04-001-007)
(NASA-CR-73494) Avail: NTIS CSCL 20E

A method of dual exposure holographic interferometry which utilizes a separate reference beam for each of the two exposures is described. It is demonstrated that the holographically recorded interference fringes can be shifted for improved visibility and that finite and infinite fringe patterns can be obtained from a single hologram. The method can be used in recording interferograms of transient phenomena, for real time interferometry, and for comparing optical components. Author

N71-14271# Technisch Physiche Dienst TNO-TH, Delft (Netherlands).
DETERMINATION OF THE BUBBLE SPECTRUM IN A CAVITY TUNNEL WITH THE HELP OF HOLOGRAPHY [BEPALING VAN HET BELLENSPECTRUM IN EEN CAVITATIE-TUNNEL MET BEHULP VAN HOLOGRAFIE]
H. J. Raterink and N. J. van der Zwaal 30 Jun. 1970 45 p refs In DUTCH; ENGLISH summary
(TDCK-55987; Rept-70-0-5) Avail: NTIS

The bubble spectrum in a cavity tunnel is of interest in fundamental cavity research. Described is an investigation of the possibility to determine the bubble spectrum by holographic means. If a hologram is made of a volume part of the cavity tunnel, then in the reconstruction step this spectrum can be determined with the aid of a microscope. For this purpose the Fraunhofer or far field holographic technique has been chosen. Provisional experiments with small objects, such as blood particles and artificial bubbles have been done. Much attention is paid to the conditions under which a good reconstruction of the hologram can be obtained. In case of the bubbles moving in the cavity tunnel with a velocity of 20 m/s an exposure time of 10 to the −7th power sec. is required. Author

N71-14326# National Bureau of Standards, Boulder, Colo.
DAMAGE IN LASER MATERIALS
Alexander J. Glass and Arthur H. Guenther, eds. Dec. 1970 130 p refs Conf. held at Boulder, Colo., 24-25 Jun. 1970
(NBS-SP-341) Avail: SOD $1.25

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13. EXOELECTRON EMISSION FROM OPTICAL SURFACE P. Braunlich (Bendix Corp., Southfield, Mich.) p 102–104 refs (See N71-14339 04-16)

14. PULSE DURATION DEPENDENCE OF LASER DAMAGE MECHANISMS E. S. Bliss (Air Force Cambridge Res. Labs., Bedford, Mass.) p 105–117 refs (See N71-14340 04-16)

N71-14327# American Optical Co., Southbridge, Mass. Central Research Lab.
RECENT DEVELOPMENTS AT AMERICAN OPTICAL CORPORATION IN GLASS LASERS
E. Snitzer *In* NBS Damage in Laser Mater. Dec. 1970 p 5–10 refs (See N71-14326 04-16)
Avail: SOD $1.25

A description is given of the quality control procedures used to obtain laser glass from an all ceramic melt facility which is suitable for use at 20J/sq cm in a 30 ns pulse. A non-destructive holographic method for the identification of damage sites is presented. Finally, some results are given on recently prepared experimental glass which appears to be entirely free of damaging inclusions and which has an absorption coefficient at 1 mu of 0.2%/cm. Author

N71-14328# Owens-Illinois Glass Co., Toledo, Ohio.
LASER GLASS DAMAGE TESTING AT OWENS-ILLINOIS
R. W. Beck *In* NBS Damage in Laser Mater. Dec. 1970 p 11–18 Sponsored by ARPA (See N71-14326 04-16)
Avail: SOD $1.25

A variety of glass samples are tested to determine their damage thresholds to laser irradiation. Active damage threshold tests in the third amplifier stage of the oscillator-amplifier system indicate that selected samples may withstand peak energy densities of 50 joules/sq cm, for 50 nano-sec pulses. The increase in the peak energy densities for damage result from improved melting

processes. The effect, thus far, is an 84% increase in the laser glass damage threshold. Active life tests in the third amplifier stage at peak energy densities of 36 joules/sq cm indicate that no degradation of the lasing properties occur for a 200 shot sequence. These results imply that for current state-of-the-art laser glass, system output degradation characteristics should at least be a part of any criterion for laser glass damage. Passive damage tests on samples approximately 0.5 cm thick by 2 cm square indicate that micron to sub-micron inclusions are most easily damaged. Author

N71-14329# Naval Research Lab., Washington, D.C.
LASER GLASS TESTING AT NRL
Thomas H. De Rieux and John M. McMahon *In* NBS Damage in Laser Mater. Dec. 1970 p 19–27 refs (See N71-14326 04-16)
Avail: SOD $1.25

Damage thresholds exhibited by several different laser glasses are reported. The performance characteristics of these glasses when operated in the VD 320 laser are discussed. Of particular importance was the anomalous gain noted when very high population inversion was attempted as well as severe pulse broadening. Author

N71-14330# Air Force Weapons Lab., Kirtland AFB, N.Mex.
EXPERIMENTAL INVESTIGATION OF THE BEHAVIOR OF NEODYMIUM-GLASS LASER AMPLIFIERS
C. R. Jones, P. V. Avizonis, and P. Sivgals *In* NBS Damage in Laser Mater. Dec. 1970 p 28–36 refs (See N71-14326 04-16)
Avail: SOD $1.25

Anomalies observed in gain measurements on neodymium glass laser amplifiers are reported. The investigation revealed a significant gain fall-off at high amplifier excitation energies. Efforts to determine the origin of this phenomenon are described. The discrepancy between the observed gain and that predicted theoretically for a neodymium glass laser amplifier is found not to be due to superradiance or flashlamp spectral shift. Furthermore, a pump-energy-dependent loss process in the glass matrix is shown not to contribute to the gain roll-off. The underlying physical process remains undetermined. Author

N71-14333# National Bureau of Standards, Washington, D.C.
ABSORBING CENTERS IN LASER GLASSES
Herbert S. Bennett *In its* Damage in Laser Mater. Dec. 1970 p 51–54 refs (See N71-14326 04-16)
Avail: SOD $1.25

Some metallic and dielectric inclusions in glass laser rods may absorb an appreciable amount of the laser radiation and thereby may produce major stresses within the glass host. The radial and tangential stress components, the stress birefringence, the optical path length change for a probing light ray passing near the inclusion, and the lens effect are computed. The dependence of the maximum value of the tensile stress upon the size of the inclusion and upon the physical properties of the host is examined. Author

N71-14334# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
THE INCLUSION PROBLEM IN LASER GLASS
R. W. Hopper, C. Lee, and D. R. Uhlmann *In* NBS Damage in Laser Mater. Dec. 1970 p 55–66 refs (See N71-14326 04-16)
(Contract ARPA SD-90)
Avail: SOD $1.25

The problem of inclusion damage in laser glass is considered anew, with attention being directed to an improved treatment of the stress around a hot inclusion particle. The existence of a layer of molten glass surrounding such particles is suggested; and the new analysis indicates a maximum tensile stress in the nearby cooler glass, rather than at the solid-liquid glass boundary. The breakdown condition is shown to depend upon the flux level and pulse time of the laser beam, as well as the size and shape of the inclusion particles and various material properties of the inclusion and glass. Under most conditions of laser operation, non-metallic inclusions, even those containing large concentrations of highly absorbing ions are expected to be safe; and under all conditions they should be appreciably less dangerous than similar metal particles. Author

N71-14336# Hughes Research Labs., Malibu, Calif.
DAMAGE THRESHOLD STUDIES IN RUBY AND SAPPHIRE
C. R. Giuliano and L. D. Hess *In* NBS Damage in Laser Mater. Dec. 1970 p 76–89 refs (See N71-14326 04-16)
(Contract F19628-69-C-0277)
Avail: SOD $1.25

A mode-controlled giant pulse ruby laser oscillator and amplifier are described. The oscillator employs a temperature-controlled resonant reflector, a dye Q-switch, and a 2 mm aperature to assure single mode operation. The results of damage threshold measurements on a few ruby and sapphire samples are discussed. Scanning electron micrographs of surface damage, and photomicrographs of bulk and surface damage are presented. The dependence of damage threshold on TiO2 doping and optical pumping is discussed, and some marked differences in the damage phenomenon between ruby and sapphire are pointed out. Author

N71-14337*# Raytheon Co., Waltham, Mass. Research Div.
LASER-INDUCED DAMAGE TO NONLINEAR CRYSTALLINE MATERIALS
Michael Bass *In* NBS Damage in Laser Mater. Dec. 1970 p 90–98 (See N71-14326 04-16)
(Contracts NAS12-2155; F19628-70-C-0223)
(NASA-CR-111767) Avail: SOD $1.25; NTIS CSCL 20E

The parameters necessary to specify surface damage to nonlinear crystals are described and the power densities descriptive of the damage process are defined. The definition of the occurrence of surface damage is discussed and preliminary experimental results given for LiNbO3, Ba2NaNb5O15 and several other materials irradiated by a Q-switched Nd:YAG laser. These results obtained using TEM sub 00 and multimode lasers are analyzed and used to provide the basis for planning future experiments. Author

N71-14339# Bendix Corp., Southfield, Mich. Research Labs.
EXOELECTRON EMISSION FROM OPTICAL SURFACES
P. Braeunlich *In* NBS Damage in Laser Mater. Dec. 1970 p 102–104 refs (See N71-14326 04-16)
Avail: SOD $1.25

The first exoelectron images obtained from dielectric materials are reported. Possible applications of the new technique in characterizing a surface with respect to laser damage are discussed. Author

N71-14340# Air Force Cambridge Research Labs., Bedford, Mass.
PULSE DURATION DEPENDENCE OF LASER DAMAGE MECHANISMS
E. S. Bliss *In* NBS Damage in Laser Mater. Dec. 1970 p 105–117 refs (See N71-14326 04-16)
Avail: SOD $1.25

A number of mechanisms for laser damage in transparent dielectrics are examined for pulse duration dependence and the results are compared with experimental measurements when possible. The differences in dependence on pulse duration and other variables from one mechanism to another suggest that different mechanisms may initiate damage in different parameter ranges. Experimental identification of these mechanisms will be aided by measuring the pulse duration dependence of the damage threshold. Author

N71-14349# Technische Hochschule in Wien (Austria). Inst. fuer Hochfrequenztechnik.
STUDIES FOR OPTICAL COMMUNICATION TECHNOLOGY (LASER) Annual Report [UNTERSUCHUNGEN ZUR OPTISCHEN NACHRICHTENUEBERTRAGUNG (LASER)]
G. Koepf, J. Riegl, and W. Laeb 31 Sep. 1970 16 p refs In GERMAN
(ON-3) Avail: NTIS

Considered is a helium-cadmium ionic laser for applications in holography and optical pattern recognition. Electrical properties and fringe effects of the gas discharge are analyzed in order to optimize initial laser output. Proposed laser applications in meteorogogical radar, three-dimensional frequency filtration, and optical pattern recognition are outlined. Included is a computer program for calculating the initial signal output of a photoconductor at arbitrary intensity distribution. Also described is a radiation measuring apparatus for the infrared region. Transl. by G.G.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-13607# Oak Ridge National Lab., Tenn.
TERNARY OXIDES OF NEPTUNIUM(IV) AND AMERICIUM(III) WITH MOLYBDENUM OR TUNGSTEN: NpM2O8, Am2M3O12 (M EQUALS Mo, W)
William Freundlich et al 1970 3 p refs Transl. into ENGLISH from Compt. Rend. Ser. C, 269, 1969 p 392-394 Sponsored by AEC
(ORNL-tr-2363) Avail: NTIS

A study was made of the systems Np-Mo-O, Np-W-O, Am-Mo-O, and Am-W-O, and identification of the ternary oxides formed was made by X-ray diffraction. Evidence is presented for solid solutions of the constitution Np(x)Th(1-x)Mo2O8 with hexagonal structure. Author (NSA)

N71-13841# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Angewandte Mathematik.
METHOD FOR SIMULATION OF THE PROCESSES OF RADIATION DAMAGE IN METALS WITH THE HELP OF AN ELECTRONIC CALCULATOR [EIN VERFAHREN ZUR SIMULATION DER PROZESSE BEI STRAHLENSCHAEDIGUNG IN METALLEN MIT HILFE ELEKTRONISCHER RECHENAUTOMATEN]
Alfred H. Scholz Apr. 1970 113 p refs In GERMAN
(JUL-653-MA) Avail: AEC Depository Libraries

A study was made of the simulation of radiation damage in metals. An energy model similar to that of Gibson et al. was used in the formulation, explicitly for copper, but generally applicable to other cubic face-centered metals. A computer program was used which was independent of the GRAPE program employed in previous radiation damage simulations. A detailed representation is given of the physical model and the energy balance. The approximation methods used are described. Data are presented on the controls, accuracy, and reliability of the methods used. The program developed is described in detail. The evaluation and processing of the information obtained from the program is considered. Examples are given which demonstrate the functioning of the methods and program. NSA

N71-13842# United Kingdom Atomic Energy Authority, Harwell (England). Applied Chemistry Div.
ELECTRON MICROPROBE ANALYSIS OF METALLIC INCLUSIONS FORMED IN IRRADIATED PuO(2.0) AND PuO(1.7) AT HIGH BURNUPS
J. H. Davies and F. T. Ewart Jun. 1970 14 p refs
(AERE-R-6310) Avail: AEC Depository Libraries; HMSO: 2s 6d; $1.50 60

Metallic inclusions formed in irradiated specimens of PuO1.7 and PuO2 at high burnups (approximately 25 at. %) and relatively low temperatures (approximately 450 C) were analyzed semiquantitatively, using an electron microprobe. The inclusions formed in PuO1.7 contained molybdenum, technetium, ruthenium, rhodium, and palladium; those in PuO2 contained no molybdenum and little technetium. The chemical significance of this observation is discussed. The high radiation levels associated with the specimens reduced the detection sensitivity of the microprobe. Instrumental modifications were designed to alleviate this problem. Author (NSA)

N71-13886# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
CONCERNING THE CONNECTION BETWEEN MELTING VACANCIES AND SELF-DIFFUSION OF METALS (VARIATIONS ON THE THEME CONCERNING THE MELTING OF METALS) [O SVYAZI MEZHDU PLAVLENIEM VAKANSIYAMI I SAMODIFFUIEI METALLOV]
V. A. Sotnev and I. E. Bocharova 1969 71 p refs In RUSSIAN
(FEI-184) Avail: AEC Depository Libraries

The processes of fusion, variations in physical properties usually associated with the formation and displacement of vacancies, and self-diffusion in metals were investigated. The effects, which are ascribed to the vacancies near the melting point are linked with the existence of high-energy atoms. The calculated forces of the activation and variation in the properties associated with these processes agree well with the experimental data. The equations derived for determining the activation energy of self-diffusion in metals agree well with the experimental results. On this basis, the activation energy of self-diffusion for 27 metals was predicted. Author (NSA)

N71-13786# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CORROSION-MECHANICAL WEAR OF EQUIPMENT
B. B. Kruman and V. A. Krupitsyna 2 Jun. 1970 115 p refs Transl. into ENGLISH of the book "Korrozionno-Mekhanicheskiy Iznos Oborudovaniya" Moscow, Mashinostroyenie Izd-Vo, 1968 p 1-104
(AD-712951; FTD-MT-24-78-70) Avail: NTIS CSCL 11/6

The book gives an account of problems of the wear of constructional steel with friction in corrosive fluids and mainly in neutral salt solutions. The mechanism of mutual corrosion-mechanical wear of plain carbon steel and the effect ofdifferent factors on the intensity of this process are described. Results are given of laboratory and industrial experiments, which allow estimating the effectiveness of different means of decreasing the wear of steel articles with friction in solutions of neutral salts. TAB

N71-13811# Bhabha Atomic Research Centre, Bombay (India).
SPECTROGRAPHIC DETERMINATION OF SOME COMMONLY OCCURRING IMPURITIES IN PURIFIED LANTHANUM OXIDE
S. V. Grampurohit and K. Swamy 1970 11 p refs
(BARC-473) Avail: AEC Depository Libraries

A dc arc method is described for the estimation of fifteen commonly occurring impurities in lanthanum oxide. The sample is ground with graphite in the ratio 1:1 and 15 mg of this mixture is taken in the cavity of a 3/16 in. graphite electrode which is used as the anode. A dc arc at 10 amps is employed to excite the spectra and a Hilger large quartz spectrograph is employed to photograph the spectrum in the region 2400 to 3300 A. Wave

N-30 plates are used. The weak line of lanthanum, the matrix element, is used as an internal standard line. The working ranges of the various elements are: Ag, Be, Ge, Mn, Pb, Sn, and V (2 to 100 ppM); B, Cr, Cu, Mg, Ni, and Sb (5 to 100 ppM); and Co and Ti (10 to 100 ppM). Author (NSA)

N71-13940# Ohio State Univ. Research Foundation, Columbus.
A STUDY OF THE MECHANISM OF STRESS CORROSION CRACKING IN THE IRON-NICKEL-CHROMIUM ALLOY SYSTEM Final Report, Jun. 1963–Jun. 1969
R. W. Staehle Feb. 1970 222 p refs
(Contract AT(11-1)-1319)
(COO-1319-82) Avail: NTIS

The final report of a program to investigate the stress corrosion cracking (SCC) of Fe–Cr–Ni alloys in chloride environments is presented. The work involved studies to determine both the direct time-to-failure data of various alloys and the mechanistic information required to understand the cracking processes. Materials used included commercial and specially prepared alloys from the Fe–Cr–Ni system. Multicomponent alloys were also prepared. Phenomenological studies were conducted in boiling MgCl2 solutions and in dilute single-phase solutions up to 289 C; chloride concentrations of 0.5 to 100 ppM and oxygen concentrations of 10 to 150 ppM were used. Mechanistic studies included thin foil corrosion studies, various electrochemical investigations, and studies of physical and mechanical properties. Conclusions are presented with respect to optimum alloy concentrations and environmental control. A coherent theory for rationalizing SCC susceptibility is described. Author (NSA)

N71-13947# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
PRELIMINARY THERMOMECHANICAL TREATMENT OF D6AC STEEL
Theodore J. Koppenaal 1 Oct. 1970 29 p refs
(Contract N00014-70-C-0223)
(AD-712485; TR-1) Avail: NTIS CSCL 13/8

The effect of preliminary thermomechanical treatment on the strength, elongation, hardness, X-ray line broadening, and prior austenite grain size of D6AC steel was investigated. In this type of treatment the deformation is performed prior to austenitizing, and rapid rate heating to the austenitizing temperature must be used. The response to preliminary thermomechanical treatment was determined as a function of prior structure, amount of prior deformation, austenitizing temperature and time, pre-austenitizing heat treatment, and tempering temperature. Thus far, the yield strength has been increased about 25 percent along with a significant increase in tensile elongation for some tempering temperatures. The tensile strength, however, remains essentially constant. A comparison of the X-ray line broadening and yield strength measurements indicates that these parameters are being influenced by the same structural changes. The results are explained on the basis of a retention of the work hardened structure (introduced during the prior deformation) through the austenite and martensite transformations. Author (TAB)

N71-13948# Pennsylvania Univ., Philadelphia. School of Metallurgy and Materials Science.
PLASTIC PROPERTIES AND FRACTURE OF TITANIUM-ALUMINUM ALLOYS Final Report, 27 May 1969–26 Jan. 1970
D. J. Trusx and C. J. McMahon, Jr. Aug. 1970 254 p refs
(Contract N00019-69-C-0252; N00019-68-C-0394)
(AD-712476) Avail: NTIS CSCL 11/6

A program was conducted to determine the effects of Al content and Ti3Al precipitation on the micro- and macroplastic behavior of low interstitial Ti-Al alloys, and also to investigate the effects of Al content and Ti3Al on the susceptibility to stress corrosion cracking in a methanol-0.61 HCl-1.0% H2O environment. The Hall-Petch parameter k sub y, an indication of degree of plastic anisotropy, remained relatively constant for solution treated alloys of compositions up to 6% Al but increased significantly at the 8% Al level and in aged Ti-6% Al and Ti-8% Al alloys. This increase in k sub y is attributed to the decrease in propensity for cross-slip at higher Al alloys, particularly when aged to form Ti3Al. The decrease in cross-slip is apparent in the change in slip mode, as observed by transmission electron microscopy, with increasing planarity of slip observed to accompany aluminum additions. In the aged alloys deformation, observed after 4% tensile strain, was confined to narrow, intense slip bands. The influence of Ti3Al on both the macro- and micro-yield stresses is athermal. Author (TAB)

N71-13949# George Washington Univ., Washington, D.C. Inst. for the Study of Fatigue Fracture and Structural Reliability.
METAL FATIGUE AT ULTRASONIC FREQUENCY
William A. Wood and Douglas E. MacDonald Aug. 1970 15 p refs
(Contract N00014-67-A-0214-0011)
(AD-712501; TR-4) Avail: NTIS CSCL 11/6

Studies by scanning electron microscope, extending previous preliminary work, show that the mechanism of plastic fatigue at ultrasonic frequencies (c. 20,000 Hertz) differs from that at the relatively low frequencies of testing normally used for engineering design (c. 2000 cpm). At the low frequency a small strain amplitude starts plastic deformation in slip zones. The zones multiply, covering the metal grain, and also degenerate slowly with progressive cycling until they form slip zone microcracks. Thus the low frequency fatigue is marked by a multiplicity of such slip zone cracks. But at the high frequency a comparable small amplitude starts only isolated slip zones in occasional grains. It turns such a slip zone into a crack quickly and causes it to propagate at a much higher velocity than at low frequency. Thus the high frequency fracture in comparison is not only localized; it is also virtually catastrophic in the localized areas. Author (TAB)

N71-13991# Brookhaven National Lab., Upton, N.Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW, VOLUME 8, NO. 2 Bimonthly Technical Progress Review
Apr. 1970 70 p ref Sponsored by AEC
(BNL-50248) Avail: NTIS

A review is presented covering all phases of high-temperature liquid-metal technology, including materials development, corrosion and mass transfer, heat transfer, fluid dynamics, instrumentation, purification, component development, physical properties, thermodynamics, chemical analysis, and power systems. This type of information is pertinent to the fast-breeder development program and to the development of nuclear-Rankine power systems for space vehicles. NSA

N71-13992# Pittsburgh Univ., Pa. Dept. of Chemistry.
THERMAL, STRUCTURAL AND MAGNETIC STUDIES OF METALS AND INTERMETALLIC COMPOUNDS Annual Report, 15 May 1969–15 May 1970
W. E. Wallace and R. S. Craig 10 Jun. 1970 182 p refs
(Contract AT(30-1)-3454)
(NYO-3454-33) Avail: NTIS

Research efforts were devoted to magnetic characteristics of intermetallic compounds containing two rare earths combined with Ni, characteristics of Y–Ni–Cu systems, characteristics of ternary intermetallic compounds containing rare earths, Fe, and Co, properties of CeNi2–CeCu2, properties of GdNi2–GdCu2, rare earth ions in hexagonal fields, structure of ternary intermetallics containing rare earths, specific heats of intermetallic Mg–Cu–Zn compounds, and magnetic properties of ternary phases containing two rare earths combined with Co. Properties of intermetallic Dy–Zr–Fe and Ho–Zr–Fe compounds are also given. NSA

N71-13993# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
URANIUM METAL CRITICALITY, MONTE CARLO CALCULATIONS AND NUCLEAR CRITICALITY SAFETY
J. T. Thomas 5 Aug. 1970 64 p refs
(Contract W-7405-eng-26)
(Y-CDC-7) Avail: NTIS

The criticality of cuboidal arrays of subcritical uranium-metal components is explored with the KENO Monte Carlo code. A sufficient number of critical experiments is described and calculated with the code using the Hasen-Roach cross-section sets to adequately verify the use of this combination to examine array conditions of interest to nuclear criticality safety. The magnitudes of changes in array reactivity associated with a number of safety considerations, usually compensated by arbitrary safety factors, are presented. Among these is a Delta K sub eff of about 4% associated with the rearrangement of the units in an array from a square to a triangular pattern together with the necessary adjustment in the lattice cell size. The effect of unit, cell, or array shape on the array reactivity is shown to lead to increases in the safety margins usually employed and to correspond to approximately 0.2 in Delta K sub eff except that extreme distortions of cell shapes can lead to increases in reactivity. Author (NSA)

N71-13997# Illinois Univ., Urbana.
SUPERPLASTIC DEFORMATION IN A EUTECTIC ALLOY OF CADMIUM AND ZINC
Edmund Alan Merriman (Ph.D. Thesis) Feb. 1970 110 p refs
(Contract AT(11-1)-1198)
(COO-1198-683) Avail: NTIS

Results of investigations conducted to determine what mechanisms operate to produce superplasticity in Cd-2n eutectics are presented. Analyses of the results lead to the conclusion that grain boundary sliding is the predominent mechanism of superplastic deformation in these eutectic alloys, and theoretical calculation results suggest that grain boundary diffusion creep may contribute to the deformation as well. The activation energy measurements indicate that prismatic slip controls the superplastic deformation rate at temperatures above about 215 C (0.91 Tm), probably by acting to accommodate grain boundary sliding. A Peierls stress-controlled glide mechanism proposed by Weertman and modified for superplastic conditions can adequately explain the observed dependence of the strain rate on stress and grain size at high temperatures. At temperatures from 150 to 215 C (0.78 to 0.91 Tm), glide of dislocations which drag Zn atmospheres seems most likely to control the strain rate. NSA

N71-13999# Boeing Co., Renton, Wash. Commercial Airplane Div.
FRACTURE TOUGHNESS AND STRESS CORROSION CHARACTERISTICS OF HIGH STRENGTH MARAGING STEEL
C. S. Carter 26 Aug. 1970 33 p refs
(AD-712723; D6-25459) Avail: NTIS CSCL 11/6

The effect of heat treatment on the tensile, fracture toughness, and stress corrosion properties of a high strength maraging steel (nominal composition 18.3 Ni-12.87 Co-4.98 Mo-0.78 Ti) is described. A maximum ultimate tensile strength of 323 ksi, combined with a fracture toughness of 62 ksi sq root of in. was achieved. This strength level appears to be the maximum which can be achieved in maraging type steels without decreasing the crack tolerance below that of currently used high strength low alloy steels. Reversion to austenite did not improve either the fracture toughness or stress corrosion resistance relative to completely martensitic microstructures with equivalent strength. Author (TAB)

N71-14007# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECT OF TRACE ELEMENTS ON PRECIPITATION IN Al-Cu ALLOYS
S. K. Das, G. Thomas, and D. Rowcliffe (Brown Boveri, Ltd., Basel, Switz.) Apr. 1970 8 p refs Presented at the 7th Intern. Congr. on Electron Microscopy, Grenoble, France, 28 Aug. - 5 Sep. 1970
(Contract W-7405-eng-48)
(UCRL-19137; Conf-700808-1) Avail: NTIS

A series of Al-4Cu alloys with and without additions of Cd, In, and Sn and a commercial 2021 Al alloy containing 6.3% Cu, 0.15% Cd, and 0.05% Sn were investigated by transmission electron microscopy and diffraction. The ternary alloys had either 0.12% Cd or 0.05% Sn or In. The size and distribution of the strain precipitates after aging the alloys for 24 hours at 163 deg are compared and the significance of the findings is discussed. D.L.G.

N71-14029# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Div.
MECHANICAL PROPERTIES OF SOME METASTABLE AUSTENITIC ALLOYS
Dilip Bhanderkar (M.S. Thesis) May 1970 75 p refs
(Contract W-7405-eng-48)
(UCRL-19628) Avail: NTIS

An investigation was initiated to gain additional information about certain metastable austenitic alloys which undergo a strain-induced martensitic transformation. The mechanical properties of these alloys were investigated as a function of the temperature of prior deformation and nickel content at various test temperatures. The properties were correlated with the progress of the transformation during straining. The results indicated that prior deformation in the neighborhood of M sub D was beneficial if the temperature of deformation was conducive to the formation of an optimum amount of precipitation of carbides. Prior deformation below M sub D resulted in the formation of some martensite during deformation and this increased the yield strength without considerable loss in ductility if the amount of martensite was limited and the M sub D was high. It was also found that austenite stability was an important factor that affected the mechanical properties. When the stability was very low, premature yielding occurred at low stresses because of stress induced martensite formation and this was accompanied by a low elongation and extraordinarily high strain hardening rate. Nickel additions stabilized the alloys and prevented premature yielding. Author

N71-14040*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF REACTOR IRRADIATION ON PROPERTIES OF A NONGALLING ALLOY
Robert A. Hasse Washington Dec. 1970 33 p refs
(NASA-TM-X-2144; E-5704) Avail: NTIS CSCL 11F

The effect of reactor irradiation on Waukesha Metal 88, a nongalling alloy, was determined at fast neutron fluences up to 1×10 to the 21st power neutrons/sq cm (neutron energy > 1.0 MeV). Average specimen bulk temperature during irradiation was 355 K. The ultimate tensile strength increased by 120 percent and the 0.2 percent offset yield strength increased by 220 ercent. The coefficient of sliding friction against 304 stainless steel was unaffected. The alloy swelled slightly during irradiation. Corrosion resistance of the alloy in contact with deionized water in-pile was good, although a slight susceptibility to crevice corrosion when mated with 304 stainless steel was noted. Author

N71-14068# Sandia Corp., Albuquerque, N.Mex.
A STUDY OF THE STRESS CORROSION CRACKING BEHAVIOR OF MULBERRY (U - 7.5 WT% Nb - 2.5 WT% ZR)
Nicholas J. Magnani, Herman Romero, and Charles J. Migliorino May 1970 35 p refs
(SC-RR-70-371) Avail: NTIS

An investigation of the uranium base alloy, Mulberry (nominal composition of 90 wt% U, 7.5 wt% Nb, and 2.5 wt% Zr) was conducted to characterize the stress corrosion cracking behavior of the alloy. Two stress corrosion cracking modes were observed: quasi-cleavage (transgranular) and intergranular. The transgranular

mode required O2 for propagation and had a critical stress intensity for crack propagation of approximately 20 KSI/in. The intergranular mode occurred both in high relative humidity air and in an aqueous environment. The critical stress intensity for crack propagation of the intergranular mode is below 10 KSI/in. Author (NSA)

N71-14069# California Univ., Livermore. Lawrence Radiation Lab.
EFFECT OF HOT WORKING ON ROOM-TEMPERATURE STRENGTH AND DUCTILITY OF A PLUTONIUM 1 WEIGHT PERCENT GALLIUM DELTA-STABILIZED ALLOY
A. D. Wheeler, W. L. Thayer, and J. L. Robbins 19 Jun. 1970 18 p refs Presented at the 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, 5–9 Oct. 1970 Sponsored by AEC
(UCRL-72547; CONF-701001-18) Avail: NTIS

High-purity Pu-1 wt% Ga specimens were hot-worked to a torsional strain of 63 at temperatures of 300, 400, and 500 C and quenched to room temperature within 20 seconds. The effects were evaluated by measuring the room-temperature strength and ductility of the quenched specimens by torsion, tension, and compression testing; all three methods showed excellent agreement. Hot working at 300 C appreciably increased the room-temperature yield and ultimate strength without loss of ductility. Hot working at 400 and 500 C significantly increased room-temperature ductility with some concurrent increase in strength. The high capacity for deformation during hot working is associated with a dynamic restoration process which results in a very fine-grained equiaxed room-temperature structure. The mechanism of this restoration process is believed to be concomitant recrystallization. The final grain size increased with increasing hot-working temperature. This grain size increase is due to the fact that grain size is a function of the steady state hot-working stress, and increases with decreasing stress. Author (NSA)

N71-14091# California Univ., Berkeley. Lawrence Radiation Lab.
ENHANCEMENT OF SUBSTRUCTURE STRENGTHENING OF MARTENSITE
I-lin Cheng May 1970 17 p refs
(Contract W-7405-eng-48)
(UCRL-19196) Avail: NTIS

The structure and mechanical properties of two types of precipitation hardenable austenite alloys were studied. One was based on Fe-22Ni-4Mo-0.28C where the precipitates were Mo2C and the other was Fe-28Ni-2Ti where the precipitates were coherent fcc gamma'(Ni3Ti) ordered phase. Both types of alloy could be transformed martensitically in liquid nitrogen, thus rendering possible the study of the effect of precipitates on the substructures of martensite and the kinetics of martensitic transformation. It was found that the substructure strengthening effect of martensite could be enhanced by dispersion hardening the austenite prior to martensitic transformation. In addition, the stabilities of the austenitic alloys were such that upon certain aging treatments, the alloys transformed partially to martensite (due to precipitation of solute atoms), thus the mechanical properties of these composite materials could be evaluated in terms of the strengthening effect of each of the component phases. Upon straining, martensite formed in both types of alloys and microstructure observations were then made. Author (NSA)

N71-14125# Joint Publications Research Service, Washington, D.C.
MAGNESIUM AND ITS ALLOYS
M. A. Eydenzon 10 Nov. 1970 7 p Transl. into ENGLISH from the book "Magniy" Moscow; 1969 p 228–235
(JPRS-51761) Avail: NTIS

Magnesium alloy manufacturing processes are summarized and corrosion resistance techniques for such alloys are discussed. Trends in improving magnesium refining and casting technology are mentioned. E.C.

N71-14130*# Boeing Co., Seattle, Wash.
FRACTURE CONTROL OF METALLIC PRESSURE VESSELS. NASA SPACE VEHICLE DESIGN CRITERIA, STRUCTURES
C. E. Tiffany NASA May 1970 65 p refs Sponsored by NASA
(NASA-SP-8040) Avail: NTIS CSCL 11F

Presented are criteria and recommended practices that aid in the design of metallic pressure vessels by minimizing the occurrence of proof-test failures resulting from cracks and assuring against preflight and flight failures. The criteria and recommended practices permit a wide latitude in the selection of materials and operational stress levels, detail design, analysis, and test to allow minimization of weight and/or cost as may be dictated by specific vehicle and mission requirements. Considered are metallic pressure vessels whose design is primarily controlled by internal pressure requirements. These vessels include high pressure gas bottles, solid propellant motor cases, and storable and cryogenic liquid-propellant tanks, both integral and removable. Author

N71-14139# Argonne National Lab., Ill.
THE EBR-2 MATERIALS-SURVEILLANCE PROGRAM. 2: RESULTS OF SURV-2
Sherman Greenberg, Robert V. Strain, and Earl Ebersole Jun. 1970 12 p refs
(Contract W-31-109-eng-38)
(ANL-7682) Avail: NTIS

Eight subassemblies containing 15 alloys used in the primary system of EBR-2, and shield graphite canned in Type 304 stainless steel, are being irradiated in the EBR-2 core at 700 F for varying periods of time and neutron dosage. Half of the alloy specimens are exposed directly to reactor sodium, and the remainder are sealed in helium. The second subassembly has been removed and subjected to a limited examination after 1581 days in the reactor core and an estimated average fluence of 7 × 10 to the 19th power n/sq cm at energy levels of 0.82 MeV. Of the materials exposed, only the Berylco-25 and tantalum experienced appreciable weight loss, and thus appear to be unsuitable for use in contact with sodium under the conditions of test. Type 304 stainless steel increased slightly in room-temperature yield strength but remained ductile. There was no evidence of loss of integrity of the canned-graphite neutron-shield structures. Tantalum samples experienced density decreases that were a function of fluence and equivalent to a maximum swelling of 0.4%. Author (NSA)

N71-14140*# Gulf General Atomic, San Diego, Calif.
SOME INVESTIGATIONS OF REFRACTORY METAL SYSTEMS OF THERMIONIC INTEREST
R. G. Hudson, M. H. Horner, and L. Yang Nov. 1969 14 p refs Presented at IEEE Thermionic Conversion Specialist Conf., Carmel, Calif., 21–23 Oct. 1969
(Contracts NAS3-4165; NAS3-8504; AT(04-3)-167)
(NASA-CR-111593; GA-9495; CONF-691024-2) Avail: NTIS CSCL 11F

Interdiffusion of the W–Ta, W–Mo, and W–Nb systems was studied in the temperature range 2000 to 2200 C. The diffusion rate was found to be in the order of W–Ta < W–Mo < W–Nb. For a diffusion time of 100 hours, the widths of the diffusion zone deduced from the concentration distribution curves of the samples studied were: (1) 2000 C 39, 88 and 130 microns; (2) 2100 C 77, 118 and 301 microns; and (3) 2200 C 134, 164 and 486 microns for the W–Ta, W–Mo, and W–Nb systems, respectively. In all the cases studied, the concentration distribution curves were unsymmetrical with respect to the Matano interface, and the diffusion constants deduced from these curves by using the Boltzmann–Matano method increased with the increase of the Ta, Mo, or Nb concentration. Kirkendall voids were observed on the Ta, Mo, or Nb side of the interface in systems studied at 2000 C, but very few or no voids were found in systems studied at 2200 C. Author (NSA)

N71-14141# California Univ., Livermore. Lawrence Radiation Lab.
INFLUENCE OF STRAIN RATE ON FLOW STRESS OF TANTALUM
K. G. Hoge 24 Jul. 1970 8 p refs Presented at 2d Intern. Conf. on Strength of Metals, Monterey, Calif., 30 Aug.–4 Sep. 1970 Sponsored by AEC
(UCRL-72321; CONF-700813-1) Avail: NTIS

The influence of strain rate on the flow stress of 99.9% pure, fully recrystallized tantalum is examined. Stress-strain curves in both tension and compression are obtained at strain rates from 0.00001 to 5,000/sec. The dependency of the upper and lower yield stress on strain rate is closely predicted by the Johnston–Gilman model. However, this model does not adequately describe post-yield hardening behavior. The Dorn–Rajnak model appears to describe the dynamic behavior better; it not only predicts yield behavior accurately but provides an excellent description of post-yield behavior. Author (NSA)

N71-14165# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
X-RAY STUDY OF OXIDATION OF A TERNARY ALLOY OF U-7.5% NIOBIUM-2.5% ZIRCONIUM (MULBERRY ALLOY)
Kazuji Terada and Henry A. Goad 23 Jun. 1970 17 p refs
(Contract AT(29-1)-1106)
(RFP-1485) Avail: NTIS

The X-ray diffraction study of the oxidation of Mulberry alloy is described. Experiments were performed at 150, 250, 400, 500, and 600 C in both dry and wet air, and with different surface preparation of the samples. Only UO2 was formed at 150 and 250 C. At 400 C, U3O8 was also formed after induction periods ranging from one-quarter to 10 hours. U3O8 was formed almost immediately at 500 and 600 C. The moisture content of the oxidizing atmosphere and the surface sample pretreatment did not appear to have any effect on the results. Author (NSA)

N71-14168# California Univ., Livermore. Lawrence Radiation Lab.
EFFECTS OF TEMPERATURE, STRAIN, AND STRAIN RATE ON THE MECHANICAL PROPERTIES OF PLUTONIUM-1 wt PERCENT GALLIUM DELTA-STABILIZED ALLOYS
Willis L. Barmore and Frank S. Uribe 22 Jun. 1970 16 p refs Presented at 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex. Sponsored by AEC
(UCRL-72544; CONF-701001-4) Avail: NTIS

Various testing methods were used to obtain the mechanical properties of Pu–1 wt % Ga delta-stabilized alloys. Stresses ranged from 250 to 20,000 psi, temperatures from 23 to 600 C, and strain rates from 0.00001 to 0.1/sec. Effects on mechanical properties of stress, temperature, and mechanical and thermal histories were studied. Strength properties obtained from compression, tension, shearing, and torsion tests were analyzed and compared, and the results are in close agreement. The flow stress increased with increasing strain rate and decreased with increasing temperature, indicating that one or more thermally activated deformation mechanisms control plastic deformation in this domain of testing. Author (NSA)

N71-14190# Oak Ridge National Lab., Tenn.
SIZE EFFECTS AND ENERGY DISPOSITION IN IMPACT SPECIMEN TESTING OF ASTM A 533 GRADE B STEEL
F. J. Witt and R. G. Berggren Aug. 1970 42 p refs Presented at the 1970 SESA Spring Meeting, Huntsville, Ala., 19–22 May 1970
(Contract W-7405-eng-26)
(ORNL-TM-3030) Avail: NTIS

A series of impact type specimens ranging in thickness from 0.1 to 12 in. were tested. The effects of size on the impact energy per unit volume of the plastically deformed material of the specimens tested were investigated using the laws of similitude. Complementary to this a model illustrating the disposition of energy between shear lip and flat fracture was proposed and satisfactorily verified by the test results. It is shown that significant size effects on impact energy existed at all temperatures and in particular a size effect of around five existed even at upper shelf temperature for 12-in. thick impact specimens when compared to the energy from thinner specimens, say a Charpy impact specimen. Author (NSA)

N71-14191# Oak Ridge National Lab., Tenn.
SOME CREEP-RUPTURE DATA FOR NEWER HEATS OF HAYNES ALLOY NO. 25 (L-605)
R. W. Swindeman Aug. 1970 20 p refs
(Contract W-7405-eng-26)
(ORNL-3028) Avail: NTIS

A number of exploratory creep- and stress-rupture tests were performed on four newer heats of Haynes alloy No. 25, over the range 649 to 1316 C. Melting practice included air, vacuum, and electroslag processes. The results confirmed that existing literature data were adequate. The rupture strengths of weldments produced in three of the heats fell within the scatter band for the base metal. Author (NSA)

N71-14208# Materials Research Lab., Inc., Glenwood, Ill.
CRACK ARREST FRACTURE TOUGHNESS OF A533 GRADE B CLASS 1 PRESSURE VESSEL STEEL
P. B. Crosley and E. J. Ripling Mar. 1970 53 p refs Prepared for Oak Ridge Natl. Lab., Tenn.
(Contract W-7405-eng-26)
(HSSTP-TR-8) Avail: NTIS

Crack initiation and crack arrest toughness measurements for ASTM A 533 grade B, class 1 steel were made using heavy section steel technology program material. At –70 F there was little difference between static initiation, dynamic initiation, and crack arrest toughness values. All fell in the range of about 40–45 ksi-square root of in. At 0 F dynamic initiation and crack arrest toughness values were both of the order of 60 ksi-square root of in. Static initiation values were generally higher, ranging to above 80 ksi-square root of in. Initiation toughness values could be altered by changing the fatigue precracking procedure or by prestressing a specimen prior to testing; the arrest toughness was not sensitive to these changes. It seems likely that at higher temperatures the arrest toughness could be distinctly lower than the dynamic initiation toughness; a few tests run at room temperature are consistent with this possibility. Author (NSA)

N71-14214# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
THE TRANSITION PHASE IN TI-NI
G. D. Sandrock and R. F. Hehemann 31 Jul. 1970 61 p refs
(Contract AT(11-1)-588)
(COO-588-19) Avail: NTIS

The martensitic transformation in near equi-atomic Ti-Ni was studied from the viewpoint that shuffles required in the martensitic transformation occur as a higher order reaction at temperatures above M sub s. In this system, a triply cubic transition phase is observed at temperatures above M sub s. Tentatively, this phase is identified with atomic displacements that may result from phonon-phonon interactions with appropriate polarizations. A lattice shear becomes evident in diffraction patterns at temperatures well above M sub s, as defined by surface relief or resistivity techniques. The concept that shuffles occur at temperatures above M sub s and lead to the martensite reaction when strains exceed a critical level appears to be valid. NSA

N71-14215# British Steel Corp., London (England). Physics Dept.
A NON-CONTACT MAGNETIC SHAPE METER FOR COLD

ROLLED STEEL STRIP
H. M. Clarke, N. Davis, and P. E. English 1970 6 p refs Presented at the IMEKO Conf. on Metrology (5th), Versailles, France, May 1970
(PB-194445; BISRA-P/4/70) Avail: NTIS CSCL 11F

Measurements of the stress distribution across the width of a steel strip in the cold mill can be used to predict the shape of the finished product. The construction and use of a non-contact system which uses the relation between stress and the magnetic properties of the strip to predict shape are described. Author (USGRDR)

N71-14289# Royal Aircraft Establishment, Farnborough (England).
THE FORMATION OF SILVER-IRON OXIDE FROM IRON HYDROXIDE AND SILVER HYDROXIDE IN ALKALINE SOLUTION [UEBER DIE BILDUNG VON SILBEREISENOXID AUS EISENHYDROXID UND SILBEROXID IN ALKALISCHER LOESUNG]
W. Feitknecht et al Aug. 1970 9 p refs Transl. into ENGLISH from Z. Anorg. Allg. Chem. (Leipzig), v. 304, 1960 p 181–184
(RAE-LIB-TRANS-1506) Avail: NTIS

All modifications of iron (3) hydroxide are transformed into silver-iron (3) oxide, AgFeO2, by reaction with freshly precipitated silver oxide in hot sodium hydroxide solutions. The transformations having different velocities for the individual iron (3) hydroxide species occur in the liquid phase. The structure of AgFeO2 is similar to that of a-NaFeO2. Author

N71-14272# National Materials Advisory Board, Washington, D.C. Div. of Engineering.
TRENDS IN THE USAGE OF BISMUTH Final Report
Aug. 1970 45 p refs Sponsored in part by Bur. of Mines
(Contract GS-OOP-94008)
(PB-194493; NMAB-268) Avail: NTIS CSCL 11F

Bismuth is obtained largely as a by-product from the ores of other metals, principally copper and lead. Its availability is greatly dependent on demand for the ores of metals with which it is associated. The principal uses for bismuth are in low melting alloys, in metallurgical additives for aluminum, carbon steel, and malleable iron, in pearlescent pigments, in pharmaceuticals, and in a varity of other small specialized applications. In many of these uses, other material may be substituted for bismuth. Author (USGRDR)

N71-14384# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
COMPATIBILITY OF MOLYBDENUM-BASE ALLOY TZM WITH LiF-BeF2-ThF4-UF4 (68-20-11.7-0.3 MOLE %) AT 1100 C
J. W. Koger and A. P. Litman Dec. 1969 16 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2724) Avail: NTIS

The TZM alloy (Mo–0.5% Ti–0.08 Zr–0.02% C) showed a very small amount of attack by the fused fluoride salt (LiF–BeF2–ThF4–UF4, 68-20-11.7-0.3 mole %) at 1100 C for 1011 hr. Corrosion manifested itself as leaching of titanium and possibly zirconium from the alloy. The TZM alloy exposed to the salt partially recrystallized, while that exposed to the vapor did not. This recrystallization was attributed to the removal of titanium and zirconium. On the basis of this single test the magnitude and mechanism of corrosion indicate no serious problems for long-term use of TZM in the vacuum distillation processing scheme for the Molten Salt Breeder Reactor. However, the strength properties of the TZM alloy would approach those of unalloyed molybdenum as salt exposure time increased; this is not considered a problem now. Author (NSA)

N71-14387# Sandia Corp., Albuquerque, N.Mex.
THE LOW STRAIN TENSILE BEHAVIOR OF MULBERRY ALLOY (7.5% Nb, 2.5% Zr, BAL U)
Charles E. Albright Jul. 1970 45 p refs Sponsored by AEC
(SC-RR-70-407) Avail: NTIS

The stress-strain response of polycrystalline, gamma-quenched Mulberry alloy (uranium, 7.5% niobium, 2.5% zirconium) was studied as a function of strain rate and compared to equilibrium stress-strain tests performed by allowing the strain to reach a maximum value at incrementally increasing stresses. Equilibrium stress-strain tests were also performed on samples prestressed to various values. Sheet tensile specimens were held at various states of strain in an X-ray diffractometer to determine crystal structural changes during deformation. Prestressed tensile bars were sectioned and examined metallographically and with the x-ray diffractometer. The diffractometer experiments yielded plots of lattice parameter versus strain which showed a shift from a body-centered cubic structure of the gamma s phase, to a body-centered tetragonal structure of the gamma o phase between 1 and 3% deformation. A semiempirical equation was developed which describes the equilibrium stress-strain behavior of Mulberry in terms of a stress induced phase transformation. Author (NSA)

N71-14457# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
ACTIVITY OF OXYGEN IN LIQUID SODIUM [AKTIVITAET DES SAUERSTOFFES IM FLUESSIGEN NATRIUM]
M. de la Torre Feb. 1970 19 p refs In GERMAN; ENGLISH summary
(KFK-1149) Avail: AEC Depository Libraries

It is shown how the distribution coefficient for a specific sodium system can be determined and how a quantitative calibration can be achieved by oxygen addition. Moreover, the dependency on temperature of the electrochemical oxygen meter is reported. The equilibrium between the oxygen content on the metal surfaces of the system and in the sodium and its dependence on temperature seem to play a major part in this case. This results in a relation concerning the dependence on temperature of the oxygen meter. This relation might explain the bad agreement with the experimental data so far determined. Author (NSA)

N71-14458# Commissariat a l'Energie Atomique, Paris (France).
VAPORIZING OF URANIUM AFTER SHOCK LOADING
P. de Beaumont and J. Leygonie (Centre d'Etudes de Gramat) 1970 10 p refs In FRENCH Presented at 5th Symp. on Detonation, Pasadena, Calif.
(CEA-CONF-1562; CONF-700803-6) Avail: AEC Depository Libraries

An explosive device using the conical implosion principle was used to induce, in uranium and copper pellets, flat high-intensity shock waves, reaching up to 15 Mb in uranium. The shock speed and the free surface velocity were determined experimentally. Various equations of state were used to interpret the results obtained in uranium; only a liquid-type equation can reproduce both these results and those obtained earlier up to 2 Mb. It is concluded in particular that the free surface velocities observed for a 15 Mb shock in uranium imply a complete vaporization of the metal during the expansion. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-13808# Army Electronics Command, Fort Monmouth, N.J.
THE STUDY OF PHOSPHORS UNDER HIGH-ENERGY BOMBARDMENT Interim Report

Isidore H. Stein Sep. 1970 28 p ref
(AD-712978; ECOM-3331) Avail: NTIS CSCL 7/4

Cathodoluminescent phosphors were investigated for light-output response under high-electron-beam voltages and extreme power input. Experimental equipment and test procedures were developed for measurement of phosphor brightness, spectral-energy distribution and efficiency under extreme excitation conditions until phosphor degradation occurred. An analysis of the response was made. Author (TAB)

N71-13812# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FRACTURE TOUGHNESS OF GRAPHITE DOUBLE CANTILEVERED BEAM SPECIMENS
L. O. Slind [1969] 20 p refs
(Contract AT(45-1)-1830)
(BNWL-CC-774) Avail: NTIS

A double cantilever beam specimen was calibrated and found useful in determining the plane strain fracture toughness of SGBF nuclear graphite, the plane strain energy release rate, and the plane strain stress intensity factor, were determined respectively at room temperature. These values are for with-the-grain fractures only. Author (NSA)

N71-13813# Oak Ridge National Lab., Tenn.
MECHANICAL BEHAVIOR OF ARTIFICIAL GRAPHITES AS PORTRAYED BY UNIAXIAL TESTS
W. L. Greenstreet, J. E. Smith, G. T. Yahr, and R. S. Valachovic Dec. 1969 46 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2727) Avail: NTIS

Stress-strain behavior which is representative of nuclear-grade, or equivalent, graphites is described and discussed. Since cyclic loading test results provided important insight into the characteristics of graphite behavior, emphasis was placed on results of this type. Monotonic loading curves were also considered, and both stress versus longitudinal strain and stress versus lateral strain curves are given for monotonic and cyclic loading. The new results given in this report are combined with results published in the literature to provide a unified description of the observed behavior. Author (NSA)

N71-13953# California Univ., Livermore. Lawrence Radiation Lab. Metals, Ceramics, and Materials.
STATIC DETERMINATION OF THE DEFORMATIONAL PROPERTIES OF SOLID MATERIALS WITH PRESSURE
A. G. Duba (Chicago Univ.), and R. N. Schock 16 Apr. 1970 18 p refs
(UCRL-50852) Avail: NTIS

An apparatus designed to axially deform materials and measure the strains produced at confining pressures up to 2 kbar is described. A uniform uniaxial stress is applied by fluid pressure to the ends of cylindrical samples and foil strain gages are used to measure the resulting longitudinal and radial strain in the samples. From these measurements, a static determination of Young's modulus and Poisson's ratio can be obtained. By varying the confining pressure, not only the pressure of the given moduli, but also the compressibility can be obtained independently of other moduli. Data obtained on four materials are presented and compared with existing data. The results for iron and glass are in good agreement with literature values. For the rock samples, the observed stress-strain relations are explained in terms of the effects of small cracks, which strongly affect the response to stress at stress levels below 10 kbar. Author

N71-13996# Gulf General Atomic, San Diego, Calif.
HIGH-TEMPERATURE IRRADIATION BEHAVIOR OF PRODUCTION-GRADE NUCLEAR GRAPHITES
G. B. Engle and A. L. Pitner 10 Jul. 1970 30 p refs
(Contracts AT(04-3)-167; AT(45-1)-1830; AT(04-3)-633)
(GA-9973) Avail: NTIS

A number of production-grade needle-coke and Gilsonite graphites were irradiated at 600 to 1280 C to maximum fluences. The needle-coke graphites behaved similarly and showed marked anisotropy in dimensional changes. At temperatures from 900 to 1280 C, they contracted in the perpendicular direction to a maximum shrinkage of about 1.5% at an exposure of 3 to 5 times 10 to the 21st power n/sq cm, and then expanded upon further irradiation. In the parallel direction, they contracted rapidly with irradiation to approximately 10% shrinkage after fluences to 8 to 10 times 10 to the 21st power n/sq cm, and then the contraction rate slowed. In contrast, the Gilsonite material showed near-isotropic behavior in dimensional changes when irradiated at 1000 to 1250 C to a fluence of 11 times 10 to the 21st power n/sq cm. No differences in dimensional changes were observed between edge-cut and center-cut specimens from an 18-in diameter production logic of needle-coke graphite. Author (NSA)

N71-13998# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
HIGH TEMPERATURE ELECTRICAL RESISTIVITY OF REFRACTORY OXIDES Al2O3
R. R. Schemmel, R. L. Gordon, and J. L. Bates Jun. 1970 34 p refs
(Contract AT(45-1)-1830)
(BNWL-1458) Avail: NTIS

Electrical insulation requirements for cables and seals in a reactor environment are becoming more stringent, and the problem of choosing an adequate insulating material for reactor instrumentation remains a difficult one. Results for Al_2O_3, emphasizing the effects of annealing history and atmosphere on the electrical resistivity are surveyed. The discrepancies pointed out show the need for careful characterization of samples and for analytical measuring procedures in establishing standard techniques to determine the electrical properties of insulating materials. Author (NSA)

N71-14014* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FIRE RESISTANT COATING COMPOSITION Patent
John B. Schutt and John W. Stuart, inventors (to NASA) Issued 3 Feb. 1970 (Filed 28 Nov. 1967) 4 p Cl. 106-15; Int. Cl. C09d5/18, 5/00
(NASA-Case-GSC-10072; US-Patent-3,493,401; US-Patent-Appl-SN-686296) Avail: US Patent Office CSCL 11C

Coating compositions are considered with combinations of inorganic materials which are both fireproof and insoluble in water after application. The coatings compositions are further flake, crack, craze, and abrasion resistant, and of greatly reduced leachability. A unique combination of potassium silicate with other materials fulfills the above mentioned specifications thus rendering it a superior coating for space vehicles. Specific examples of the composition are given with additives included of standard pigments and fillers. E.M.C.

N71-14042# Joint Publications Research Service, Washington, D.C.
REPORT FROM THE MATERIALS INSTITUTE IN THE UKRAINE
G. V. Samsonov, ed. 16 Nov. 1970 45 p Transl. into ENGLISH from the book "Institut Problem Materiyaloznavstva" Kiev, 1969 p 71-142
(JPRS-51792) Avail: NTIS

The recent developments in new materials suitable for modern engineering requirements are reviewed. The technical processes for the manufacture, and applications of metal-ceramic antifrictional

materials are discussed with porous penetrable metallic materials. The properties of electrical engineering, radio engineering, and protective materials are also presented. F.O.S.

N71-14049*# Techtran Corp., Glen Burnie, Md.
PROCESS FOR PRODUCING FLAME RESISTANT POLYURETHANE FOAMS [VERFAHREN ZUM HERSTELLEN SCHWERENTFLAMMBARER POLYURETHANSCHAUMSTOFFE]
Ferdinand Mayer Washington NASA Jan. 1969 8 p refs Transl. into ENGLISH of German Patent no. 1177816 (14 Feb. 1963) 3 p
(Contract NASw-1695)
(NASA-TT-F-12735) Avail: NTIS CSCL 11I

A process for manufacturing flame resistant polyurethane foams by foaming a mixture of organic diisocyanates in organic compounds with at least two interchangeable hydrogen atoms. A mixture of 10 to 30% by weight of post-chlorinated polyisobutylene with a chlorine content of 35 to 70% by weight and 0.5 to 5% by weight of an organic metal salt complex compound of metals of groups of 1B, 5A, 6A, 7A and 8 of the periodic system of elements (with reference to the total amount of weight of the initial material forming and polyurethane foam) is used as chlorinated polyalkaline and metal salt. Author

N71-14064*# Monsanto Research Corp., Dayton, Ohio.
THERMALLY RESISTANT POLYMERS FOR FUEL TANK SEALANTS Quarterly Report, 1 Jul.–30 Sep. 1970
James A. Webster 22 Oct. 1970 33 p refs
(Contract NAS8-21401)
(NASA-CR-102951; QR-7) Avail: NTIS CSCL 11A

Experimental polyisocyanurate- and polyimide-linked fluorocarbon polymers for high temperature sealant applications are described. Preliminary thermal stability and titanium stress corrosion evaluations are discussed. Author

N71-14072# Central Technical Inst., TNO, The Hague (Netherlands).
THERMAL SHOCK INVESTIGATIONS
J. A. Knobbout and N. van Bezooyen Oct. 1969 11 p
(Rept 69-03952) Avail: NTIS

The effects of thermal shock on plastic materials and adhesives used for insulation of cryogenic fuel storage tanks are discussed. A polyurethane foam is used to attach a plastic material to the interior of an aluminum tank. Liquid nitrogen is introduced into the tank, after which hot nitrogen is introduced in order to create a thermal shock. Inspections of the tank were made after 50 and 100 thermal shocks to determine the adverse effects. Author

N71-14137# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF PARTICLE SHAPE ON THE ABRASIVENESS OF LAMELLAR SOLIDS
J. P. Giltrow and A. J. Groszek (British Petroleum Co. Ltd.) Feb. 1969 25 p refs
(RAE-TR-69024) Copyright. Avail: NTIS

The abrasiveness of graphite samples of controlled shape was shown to be related to the aspect ratio of the crystallites. A decreasing aspect ratio results in increasing abrasiveness. Whilst the same kind of relationship is valid for MoS2, its more complex surface chemistry does not yet permit the direct calculation of crystal aspect ratios. The particle shape effect on the abrasiveness of graphite and MoS2 is interpreted in terms of the probability of crystals presenting edge faces to the surfaces in the sliding environment. Author

N71-14138*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ABLATION PERFORMANCE OF GLASSLIKE CARBONS, PYROLYTIC GRAPHITE, AND ARTIFICIAL GRAPHITE IN THE STAGNATION PRESSURE RANGE 0.035 TO 15 ATMOSPHERES
Howard G. Maahs Washington Dec. 1970 34 p refs
(NASA-TN-D-7005; L-7290) Avail: NTIS CSCL 11B

The ablation performance of two glasslike carbons, one pyrolytic graphite, and one artificial graphite (ATJ) has been determined in air in five different test environments. The stagnation pressures of these environments ranged from 0.035 atm to 15 atm, and the total enthalpies ranged from 2 MJ/kg to 35 MJ/kg. Surface temperatures ranged from 1600 K to 3450 K. In the higher pressure environments, the mass-loss rates of the glasslike carbons and the pyrolytic graphite were significantly lower than that of the ATJ graphite; however, the pyrolytic graphite tended to delaminate unpredictably. The glasslike carbons tended to develop small pits or craters in their stagnation regions, and wavelike rings, suggestive of surface melting, sometimes formed about their stagnation regions. The observed mass-loss rates of the several materials studied do not agree well with the diffusion-limited rates predicted by commonly accepted graphite ablation models even though, on the basis of surface temperature and stagnation pressure, the ablation rates should be diffusion limited. In addition, the mass-loss rates of the several materials differ considerably from one another. These facts suggest that the mass-loss rate of carbon is not, at the present test conditions, diffusion limited. Empirical correlations relating mass-loss rate to surface temperature and stagnation pressure were developed for the several materials studied. Author

N71-14212# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
SOME EFFECTS OF APPLIED STRESS ON EARLY STAGES OF CAVITATION DAMAGE
Dale J. Kemppainen and Frederick G. Hammitt Apr. 1970 30 p refs Presented at the Symp. on Fluid Mech. and Design of Turbomachinery, Philadelphia, 31 Aug.–3 Sep. 1970
(Grant NSF GK-1889)
(KAPL-P-3886; CONF-700808-1; Rept-01357-16-T) Avail: NTIS

A substantial decrease in the number density of small pits, in the early portion of a test when the materials were subjected to an external compressive stress was found. There was little difference between tests run under compression between the mercury facility and the vibratory facility. The application of a tensile load in both the mercury facility and the vibratory facility caused very little or no difference in the amount of damage compared to that while under zero load. Photographic investigation of individual pits shows that they are approximately circular. These photographs strengthen the hypothesis that these pits result from the impact of liquid microjets generated during bubble collapse rather than by spherical shock waves radiating from the center of collapse. The effect of an externally applied compressive stress appears to be diminished after the damage has initially disrupted the surface. Author

N71-14261# National Research Council of Canada, Ottawa (Ontario).
VAPOUR SPACE INHIBITOR STUDIES, PART 1 AND 2
L. New and J. Lowe May 1970 21 p refs
(NRC-11644; MP-54) Avail: NTIS

CONTENTS:

1. THE EFFECT OF N-DECANOIC ACID ON THE OXIDATION CHARACTERISTICS OF STEAM TURBINE OILS p 2–3 (See N71-14262 04-18)

2. DEVELOPMENT OF A LABORATORY METHOD FOR MEASURING THE PRESENCE AND EFFECTIVENESS OF VAPOUR SPACE INHIBITORS IN OILS p 4–17 refs (See N71-14263 04-18)

N71-14262# National Research Council of Canada, Ottawa (Ontario).

THE EFFECT OF n-DECANOIC ACID ON THE OXIDATION CHARACTERISTICS OF STEAM TURBINE OILS. PART 1

In its Vapour Space Inhibitor Studies. Part 1 and 2 May 1970 p 2–3 (See N71-14261 04-18)

Avail: NTIS

Two qualified steam turbine oils and one base stock were used for the test blends. Infrared analysis of extracts of the two finished oils indicated the oxidation inhibitor to be a phenol type (4 methyl 2, 6 ditertbutyl phenol) present in concentrations of approximately 0.2 and 0.4 percent by weight. Therefore, the base stock was used to prepare samples containing phenyl-alpha-naphthylamine. From these basic blends test oils containing the n-Decanoic acid were prepared. Test procedures were varied (e.g. by adding metal deactivator or omitting the copper catalyst) to provide additional information. The samples prepared, test procedures, and results are summarized in tabular form. Author

N71-14263# National Research Council of Canada, Ottawa (Ontario).

DEVELOPMENT OF A LABORATORY METHOD FOR MEASURING THE PRESENCE AND EFFECTIVENESS OF VAPOUR SPACE INHIBITORS IN OILS. PART 2

In its Vapour Space Inhibitor Studies. Part 1 and 2 May 1970 p 4–17 refs (See N71-14261 04-18)

Avail: NTIS

The development of a potential laboratory glassware corrosion test method for measuring the presence and effectiveness of vapor space corrosion inhibitors is described. The method offers versatile control of temperatures of environment and specimen and demonstrates good repeatability and reproducibility for uninhibited and adequately inhibited oils. Author

N71-14287*# Whittaker Corp., San Diego, Calif. Research and Development Div.

BORON/GRAPHITE HYBRID COMPOSITE DEVELOPMENT STUDY Final Report

Harold A. Evenson 30 Aug. 1970 168 p refs

(Contract NAS8-24510)

(NASA-CR-102944) Avail: NTIS CSCL 11D

A hybrid composite, consisting of boron and graphite fibers in a NMD 2387 epoxy matrix, has been investigated both analytically and experimentally, and processing and material design procedures have been established and demonstrated. It is pointed out that there are three ways to enhance the properties of a boron/epoxy composite laminate: (1) augmentation, in which the volume fraction of boron fiber is increased with no graphite fiber added; (2) interleaving, in which boron/epoxy and graphite/epoxy preprege are interleaved prior to curing; and (3) mixing, in which boron and graphite fibers are intermixed prior to prepregging. The latter concept achieves the best improvement in transverse tensile and in-plane shear stiffness properties, but the absolute magnitudes of these improvements are not, in themselves, sufficient to warrant replacement of the Augmented composite concept. The potential improvements in longitudinal properties are rather small when considered on the basis of specific strength and modulus properties, and it is concluded that use of the mixed composite as a replacement for the boron composite is unjustified unless the fiber mixing process can be achieved at very little additional cost. Author

N71-14288# National Materials Advisory Board, Washington, D.C. Div. of Engineering.

TRENDS IN USAGE OF RARE EARTHS Final Report

Oct. 1970 80 p refs

(NMAB-266) Avail: NTIS

The sources of rare earths are presented together with current and anticipated usage in various applications. Projected needs for rare earths are considered in terms of expanded present uses and development of new applications, based on known and anticipated technological advances. There are several known and proposed domestic sources of light rare earths that give assurance of their availability under emergency conditions. Substantial price advances would be needed to increase the production of yttrium and the heavy rare earths. Rare earths are used in the unseparated form (catalysts, nodulizer in irons, etc.) and as individual elements (glass colorizer, phosphors, etc.). Individual applications are expected to change considerably with time but the overall usage trend is upward. Recently, rare earths were removed from the list of strategic and critical materials to be maintained in the national stockpile. Author

N71-14324# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.

EXPERIMENTS TO DETERMINE OXIDE AND METAL SOLUBILITIES IN CALCIUM CHLORIDE MELTS [VERSUCHE ZUR LOESLICHKEITSBESTIMMUNG VON OXIDEN UND METALLEN IN GESCHMOLZENEM CALCIUMCHLORID]

Johannes Otto Mispagel (Ph.D. Thesis) 1970 83 p refs In GERMAN

Avail: NTIS

Solubility conditions for oxides in calcium chloride melts at 1000 C were studied. Basic zirconium oxide dissolved in the melt to 3.5 plus or minus 1.1 ppm. Solubility of acidic silicon oxide was 0.2 mMol/g CaCl2; the relatively high solubility of this oxide was attributed to the presence of CaO in the melt. Amphoteric Al2O3 did not dissolve in CaCl2 at 1000 C. Evaluation of ceramic crucibles made of Al2O3, ZrO2 and tungsten, for their usefulness as molten calcium chloride containers established their permeability; also observed were tungsten and molybdenum diffusions into the melt. Deep drawn nickel crucibles had a nickel solubility in calcium chloride melts at 1000 C of 45.0 plus or minus 2.7 ppm. Transl. by G.G.

N71-14331# Compagnie Generale d'Electricite, Paris (France). Div. des Applications Optiques.

FILAMENTARY DAMAGE IN GLASSES

J. Davit *In* NBS Damage in Laser Mater. Dec. 1970 p 37–44 refs (See N71-14326 04-18)

Avail: SOD $1.25

The diameter of the self-focusing filament in glass is measured by different means, all of which give self-consistent results. The filamentary damage threshold is related to a self-focusing length. The experiments show that the filamentary damage threshold varies with the length of the glass as indicated by the theory of self-focusing only for lengths of glass that are smaller than the self-focusing length. Author

N71-14332# Bell Telephone Labs., Inc., Murray Hill, N.J.

MEASUREMENT OF THE NONLINEAR INDEX n2 OF GLASS USING PICOSECOND PULSES

Michel A. Duguay and John W. Hansen *In* NBS Damage in Laser Mater. Dec. 1970 p 45–50 refs (See N71-14326 04-18)

Avail: SOD $1.25

Picosecond pulses from a mode locked neodymium glass laser and the ultrafast Kerr cell apparatus were used to measure the nonlinear birefringence index of BK7 and LaSF7 glasses. On the assumption that the Kerr effect in glass was predominantly of electronic origin the value was approximated to be 2.7 times 10 to the minus 13th power esu for the nonlinear birefringence index of BK7 glass. Laser glass was assumed to have about the same value. At power densities of about 1 GW/sq cm this gave rise to refractive index increases of about 0.000001; this is sufficient to explain the appearance of self-focusing in glass laser rods which leads to the formation of long fossile tracks of microscopic bubbles. In addition, nonlinear birefringence leads to pulse spectral broadening and gain limiting. Author

N71-14339# Colorado State Univ., Fort Collins. Quantum Electronics Lab.

RAMAN SCATTERING IN MICROSCOPICALLY DAMAGED QUARTZ

David F. Edwards, C. Y. She, J. D. Masso, Y. D. Harker, and H. C. Schade *In* NBS Damage in Laser Mater. Dec. 1970 p 97–101 refs Sponsored in part by AFCRL (See N71-14326 04-16)

Avail: SOD $1.25

Raman scattering is being used to study microscopic damage in crystalline quartz. Three experiments have been performed to date. The Raman spectrum of undamaged quartz was measured to serve as a standard from which the criteria for microscopic damage may be defined. A controlled defect experiment was next in which was measured the effect of an applied uniaxial stress on the Raman spectrum. A modified-valence force model was developed to calculate the stress dependence of the Raman shift for the A sub 1-vibrations. The agreement between the observed and calculated values was satisfactory. Quartz samples were damaged by a Q-switched ruby laser and changes in the Raman spectrum were observed and are reported here. Author

N71-14341# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

HEAT TRANSFER THROUGH FABRICS

Alice M. Stoll and Maria A. Chianta 16 Sep. 1970 43 p refs (AD-712505; NADC-MR-7017) Avail: NTIS CSCL 11/5

Heat is transferred through fabrics by convection, conduction and radiation and under certain circumstances by vaporization. Each mode is subject to different physical principles but the effect of the total heat absorbed by underlying skin is the same: if the resultant skin temperature rise is sufficiently high and maintained sufficiently long, injury results. The extent of injury is predicted under certain controlled conditions and these conditions may be used to disclose protection principles appropriate to each mode of transfer. Author (TAB)

N71-14372# Iowa State Univ. of Science and Technology, Ames.

THERMAL DIFFUSIVITY OF TiB2 ZrB2, AND HfB2

Thomas Michael Branscomb (M.S. Thesis) Feb. 1970 92 p ref (Contract W-7405-eng-82)

(PB-192253; JS-T-368) Avail: NTIS CSCL 11B

The thermal diffusivities of dense polycrystalline ceramics of TiB2, ZrB2, and HfB2 were measured by the flash method over the temperature range 200C to 1300C. Values of diffusivity ranged from 0.32 to 0.16 (sq cm)/sec. A cursory investigation of the effects of radial heat flow was performed and a special sample shape was used to comply with the assumption of one dimensional heat flow. The thermal conductivity of the diborides was calculated from the diffusivity data and found to be significantly higher than previously reported values. Values of conductivity ranged from 1.05 to 0.71 watts/cm-deg over the temperature range measured. The accuracy and precision were estimated to be less than 5% from comparisons of data with published data on Armco iron and platinum. Author (USGRDR)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N71-13623# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.

ON THE THEORY AND APPLICATION OF FINITE OVERLAP MINIMIZATION [ZUR THEORIE UND ANWENDUNG ENDLICHER MINIMALUEBERDECKUNGEN]

Hans-Dieter Ehrich (Ph.D. Thesis) 1970 151 p refs In GERMAN Avail: NTIS

Considered are minimal covering problems where a n-element sum N and a system M of m partial states is given and covers the N. The basic problem consists in selecting the lowest possible sums of M so that this selection covers N. Boolean vectors and matrices are used to define exact maximal cover in a sum associated with C-relation cover. The concept of attributable C-relation (reflexive and symmetrical) makes it possible to obtain normalized forms of cover matrices which in turn are used to calculate the minimal cover. Applications of the described algebraic method in discrete optimization problems of logical circuits, automata theory, graph theory, and marketing research are outlined. Transl. by G.G.

N71-13633# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

A METHOD FOR STUDYING THE INTEGRAL FUNCTIONALS OF STOCHASTIC PROCESSES WITH APPLICATIONS, 3

Prem S. Puri Sep. 1970 29 p refs *Its* Mimeograph Ser. No. 243

(Contracts Nonr-1100(26); N00014-67-A-0226-0008) (AD-712488) Avail: NTIS CSCL 12/1

The paper is concerned with the problem of obtaining the joint distribution of X (t) and integrals of the form Y (t) = the integral from 0 to t f ((X (tau), tau)) d tau, where X(t),t > or = 0 is a continuous time parameter stochastic process appropriately defined on a probability space, with Z as its state space; f is a nonnegative measurable function defined on Z x the interval 0 < or = x < infinity. It is assumed that the integral Y (t) exists and is finite almost surely for every t > 0. In another paper, a method was introduced by the author for obtaining the joint distribution of X (t) and Y (t). This method is based on an auxiliary process Z (t) called 'quantal response process,' defined as in the text. In this paper, the method is applied to birth processes, both time homogeneous and time nonhomogeneous. The results so obtained are then specialized to the case of simple epidemic and to certain well-known processes such as the Poisson process and Polya process. The method is also applied to certain well-known birth and death processes such as linear birth and death processes with immigration, and M/M/I queue. The paper ends with an application to illness and death processes. In each of these cases, distributions of certain useful integrals are explicitly derived by using the above technique. Author (USGRDR)

N71-13681# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

RELATIVISTIC THREE BODY PROBLEM IN RELATIVE VARIABLES

V. M. Vinogradov 1970 26 p refs In RUSSIAN (JINR-P2-5100) Avail: AEC Depository Libraries

On the basis of the three-dimensional formulation of quantum field theory the Lorentz-covariant three-body theory is constructed in momentum space. Relativistic Jacoby momenta are introduced by means of the additional operation of 4-vectors in the Lobachevsky space. It is shown that the motion of the center of mass system can be separated and the problem is formulated only in relative variables as a direct generalization of the nonrelativistic theory. The three-dimensional relativistic analog of the Faddeev equations for the scattering amplitude as well as the analog of the Schrodinger equation for three body system are obtained. The system satisfies three-body unitarity and the correspondence principle. Author (NSA)

N71-13758*# State Univ. of New York, Stony Brook.

DIRECT METHODS FOR THE SOLUTION OF SYSTEMS OF LINEAR EQUATIONS WITH SPARSE COEFFICIENT MATRIX AND RELATED TOPICS Final Report, 1 Dec. 1967–31 Aug. 1970

Reginald P. Tewarson Aug. 1970 11 p refs (Grant NGR-33-015-013)

(NASA-CR-115777) Avail: NTIS CSCL 12A

Selected summaries are presented for research in computations involving sparse matrices. The research indicates that significant savings in time and computing effort are possible if suitable row-column permutations are performed on such matrices. Such permutations extend the size and scope of problems that can be solved on the present generation of computers. The generalized inverse of a matrix and the least squares solution of equations are more feasible because of the derived algorithms. These algorithms also facilitate determination of the Chebyshev solution of a system of equations. Author

N71-13807# RAND Corp., Santa Monica, Calif.
PROOF OF THE HEAWOOD CONJECTURE FOR NON-ORIENTABLE SURFACES
J. W. T. Youngs Sep. 1970 114 p refs
(AD-712714; P-4467) Avail: NTIS CSCL 12/1

The paper provides a proof of the fact that the chromatic number of the non-orientable surface which is a sphere with q cross-caps is the integral part of (7 + square root of (1+24q))/2, unless q = 2. In the exceptional case the chromatic number is 6. Author (TAB)

N71-13815# Wisconsin Univ., Madison. Dept. of Statistics.
ON A HISTOGRAM METHOD OF DENSITY ESTIMATION
J. Van Ryzin Mar. 1970 51 p refs
(Grant NSF GP-9324)
(PB-192460; UWIS-DS-70-228) Avail: NTIS CSCL 12A

Let Y1, Y2,..., Yn,(Y1 + or − or < Y2 + or − or <...+ or − or < Yn) be an ordered sample from a distribution F with density f on the real line. A class of density estimates of the histogram type based on differences of the form Y (j+k) - Yj, k + or − or > 1, j+ or − 1,..., n-k, are proposed and studied. The estimates are shown to be both weakly and strongly consistent at all points x (epsilon)C (f), the continuity set of f, under suitable conditions. Asymptotic distributions of the estimates are given for differing sets of assumptions. Comparisons and efficiencies relative to the kernel type methods of Rosenblatt and Parzen and the histogram method of Revesz are examined. Author (USGRDR)

N71-13820# Stanford Univ., Calif. Dept. of Statistics.
ASYMPTOTIC RESULTS FOR GOODNESS-OF-FIT STASTICS WHEN PARAMETERS MUST BE ESTIMATED
M. A. Stephens 10 Aug. 1970 31 p refs
(Contract N00014-67-A-0112-0053)
(AD-712757; TR-159) Avail: NTIS CSCL 12/1

The paper considers the asymptotic distribution of the goodness-of-fit statistics W squared and U squared when parameters of the tested distribution must be estimated from the sample. The asymptotic mean and variance are found for the cases when, in testing for normality, either mu or sigma squared or both must be estimated, and when, in testing for exponentiality, the scale parameter must be estimated. Section 2 also gives a list of integrals connected with the normal distribution, which might have other uses. Author (TAB)

N71-13821# California Univ., Berkeley. Dept. of Computer Sciences.
A GEOMETRIC CONVERGENCE THEORY FOR THE QR, RAYLEIGH QUOTIENT, AND POWER ITERATIONS
William George Poole, Jr. Aug. 1970 65 p refs
(Contracts Nonr-3656(23); N00014-69-A-0200-1017)
(AD-712444; TR-41) Avail: NTIS CSCL 12/1

The basic QR, LU, treppen, and bi-iterations are shown to produce the same sequence of subspaces as do direct and inverse iteration started from the appropriate subspaces. The methods differ only in the bases with which these subspaces are defined. A unified, complete geometric convergence theory is developed in terms of the power method. Author (TAB)

N71-13841# California Univ., Berkeley. Lawrence Radiation Lab.
A COMPUTER PROGRAM FOR THE SMOOTHING AND DIFFERENTIATION OF DATA FROM MULTICHANNEL ANALYZERS
D. J. Gormann Jun. 1970 39 p refs
(Contract W-7405-eng-48)
(UCRL-18903) Avail: NTIS

In the interpretation of spectra taken on multichannel analyzers it is frequently helpful, especially in cases where the statistics are poor, to smooth the data in order to reduce the statistical fluctuations. When presented with such a spectrum one would normally draw through the points a smooth curve which best fits them. This can be done numerically once it is defined what is meant by best fit. The most common criterion is to minimize the sum of the squares of the residuals between the actual and fitted points. A method is described in which the procedure is to fit a polynominal over a range of (2m + 1) data points and use that to evaluate the smoothed value at the mid-point. The data points taken are then shifted by one, dropping the point at the left and picking up one at the right. This process is repeated to cover the entire spectrum. Upon doing one least squares analysis one obtains a set of coefficients, one for each point over which the fit is performed. The value at the mid-point of one interval (2m + 1) points is found by summing the products of the counts in each channel and the particular coefficient for that channel. Author (NSA)

N71-13950# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
NONLINEAR CONTROLLABILITY AND INVOLUTORY ACTUATOR ORBITS
Alexander Chen-Che Liang Aug. 1970 79 p refs
(Grant AF-AFOSR-1244-67)
(AD-712716; USCAE-119; AFOSR-70-2200TR) Avail: NTIS CSCL 12/1

The general multi-dimensional linear optimal control problem with quadratic cost functional and nonquadratic weighting on the final states is completely solved in closed form by utilizing Caratheodorys construct on of C sup 2 solutions to the Hamilton-Jacobi equation associated with the control problem. The same method is also applied to a broad spectrum of nonlinear control processes with nonquadratic cost functionals. Necessary and sufficient conditions for complete controllability of a general class of nonlinear control systems are derived. The derivation of these conditions makes use of properties of certain Pfaffian equations associated with the control system and properties of the Penrose pseudo-inverse of matrices. The idea of involutory actuator orbits is introduced. A class of nonlinear control processes with involutory actuator orbits is shown to have an equivalent class of linear systems with non quadratic cost functionals. Author (TAB)

N71-13957# Idaho Nuclear Corp., Idaho Falls.
TWO CONTRIBUTIONS TO THE THEORY OF DIGITAL FILTERING
A. L. Connelly Jul. 1970 37 p refs
Contract AT(10-1)-1230)
(IN-1411) Avail: NTIS

The properties of finite, digital approximations to power spectra and crosspower spectra and of digital filters are reviewed. A relationship in a matrix formulation is developed between the time domain and the frequency domain for digital filters. Also a method is developed of more readily analyzing the frequency domain properties of the Otnes family of trigonometric filters. Author (NSA)

N71-14036*# Aerojet-General Corp., Sacramento, Calif. Nuclear Rocket Operations.
TREE ANALYSIS CODE (TRACE) PROGRAM E84106. NERVA PROGRAM

T. N. Throckmorton and H. R. Tayama Oct. 1969 55 p refs
(Contract SNP-1)
(NASA-CR-111366; RN-DR-173) Avail: NTIS

The Tree Analysis Code program performs a Monte Carlo simulation of fault trees to assist in analyzing large complex systems. It provides estimates of the probability of system failure prior to specified time and detects minimal sets of components whose failure causes system failure. The time-to-failure for a component is assumed to be a random variable following an exponential distribution. Because system failures are normally rare events, the technique of importance sampling is used to reduce the number of trials required. NSA

N71-14039*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
TECHNIQUES FOR MANIPULATION OF LONG POISSON SERIES
J. R. Cherniack 29 Oct. 1970 16 p refs
(Grant NGR-09-015-002)
(NASA-CR-111763; SAO-Special Rept-328) Avail: NTIS CSCL 12A

Some algorithms are considered that manipulate long trigonometric series and are symbolic expressions. An efficient algorithm for converting trigonometric polynomials to trigonometric series is described. The results are independent of the order of terms of trigonometric series. Physically interesting trigonometric series are often very long; their multiplication, addition, and differentiation are discussed. These techniques are used extensively in SPASM. E.M.C.

N71-14076# Electricity Council Research Center, Capenhurst (England).
RUNGE-KUTTA METHODS FOR THE INTEGRATION OF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
P. Basnett Mar. 1970 33 p refs
(ECRC/N261) Avail: NTIS

Computer subroutines are presented for four new Runge-Kutta methods of integrating systems of first order ordinary differential equations. The methods include automatic step size control to obtain the required accuracy in the solution with as small an amount of work as possible. The different methods are all quite efficient but under particular circumstances, discussed in the note, any one of the methods may be more efficient than the rest. Author

N71-14147*# Bellcomm, Inc., Washington, D.C.
ACCURATE APPROXIMATE SOLUTIONS TO OSCILLATORY PROBLEMS WITH PERTURBING SINGULAR DAMPING
C. C. H. Tang 30 Nov. 1970 30 p refs
(Contract NASw-417)
(NASA-CR-115774; TM-70-1011-8) Avail: NTIS CSCL 12A

An attempt is being made to obtain approximate solutions of improved accuracy for a class of differential equations in search for analytic solutions to a linearized form of the restricted three-body problem where epsilon is a real parameter less than unity, omega sub c is a positive real constant of order unity, and mu(x) is a singular function of x in the region of interest. It does not appear to be possible to obtain a general analytic expression for the error estimate of the approximate solution. For the case mu(x) = 0.0x, however, it is shown that the approximate solution is accurate to O(epsilon squared), as x → 0(−) from negative values, by comparing it with the numerically integrated solution. For the same case, the approximate solution is orders of magnitude more accurate than Poincare's first order perturbation solution. The approximate analytic solution of the present method can yield significant mathematical and physical insight to actual problems. Author

N71-14157*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
REALIZATION THEORY OF RATIONAL TRANSFER MATRICES
W. M. Wonham [1970] 30 p refs
(NASA-TM-X-66515; PM-102) Avail: NTIS CSCL 12A

The discussion centers around the algebraic connection between a rational transfer matrix H (Lambda) and its realization by a time-invariant dynamic system, or triple of constant matrices (C,A,B). It is shown that both H (Lambda) and its matrix realizations can be represented by a suitable morphism of modules over the ring of polynomials in Lambda. Morphisms of this type are the fundamental algebraic objects in the theory of finite, constant linear systems. This development is presented as a basis for research on certain problems of the syntheses of multivariable systems, which have not so far been treated for a module-theoretic viewpoint. E.M.C.

N71-14165*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FREQUENCY DOMAIN CRITERIA FOR STABILITY OF SYSTEMS MODELED BY CERTAIN PARTIAL DIFFERENTIAL EQUATIONS
J. Anton, P. Falb, and M. I. Freedman Oct. 1969 9 p refs Presented at the Iutam Conf., Herrenalb, Germany, Sep. 1969
(Grants AF-AFOSR-0693-67; NSF GK-2788)
(NASA-TM-X-66514; AD-696148; AFOSR 69-2690TR) Avail: NTIS CSCL 12A

In recent years many of the methods used to investigate stability of lumped parameter systems have been extended to study the stability of distributed systems. An extension of the circle-criterion is applied to Hilbert space valued systems, as well as some rather sophisticated results on elliptic boundary value problems. The stimulus for the approach is the desire to have calculable criteria for stability. Author

N71-14173*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
POLYNOMIAL MATRICES, REPRESENTATIONS, AND LINEAR SYSTEM THEORY
William A. Wolovich Mar. 1970 30 p refs
(NASA-TM-X-66512; PM-105) Avail: NTIS CSCL 12A

Frequency domain analogies are presented of controllability, observability, state feedback, state estimation, and the notion of transfer matrix realization. The analogies provide additional insight into the structure of linear systems, as well as offer alternative procedures for the analysis and design of linear multivariable systems. The manipulation of polynomial matrices is also discussed, and several definitions and preliminary results regarding this class of matrices are given. A basic result involving a frequency domain characterization of linear systems is proved. This result, which is called a representation theorem for a rational transfer matrix, employs polynomial matrices and is analogous to the time domain concept of a realization for a rational transfer matrix. The utility of this result for obtaining realizations is then demonstrated. A practical application of transfer matrix representations is made which deals with the frequency domain analog of state feedback and estimation. Author

N71-14174*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ON THE STRUCTURE OF MULTIVARIABLE SYSTEMS
W. A. Wolovich and P. L. Falb (Brown Univ.) Nov. 1968 30 p refs
(Grant NSF GK-2788)
(NASA-TM-X-66511; PM-73) Avail: NTIS CSCL 12A

A structure theorem for time invariant multivariable linear systems is stated and proved. The theorem can be used for controller design and synthesis and is applied here to the problems of realization and decoupling. Author

N71-14175*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

DECOUPLING AND POLE ASSIGNMENT BY DYNAMIC COMPENSATION
A. S. Morse and W. M. Wonham Jul. 1969 40 p ref
(NASA-TM-X-66510; PM-86) Avail: NTIS CSCL 12A

The extended decoupling problem for a constant multivariable system is stated and solved. Under certain restrictions, the problem of minimizing the order of dynamic compensation (i.e., the dimension of the extended state space) is solved. This solution is actually the best possible if the number of scalar inputs is equal to the number of output blocks to be decoupled. The role of state space extension in pole assignment is determined. It is shown that, with dynamic compensation of high enough order, any pole distribution can be synthesized for the decoupled system, whenever decoupling is possible at all. Author

N71-14180# Pittsburgh Univ., Pa. Dept. of Physics.
UNITARY IRREDUCIBLE REPRESENTATIONS OF SU(2,2). REDUCTION WITH RESPECT TO AN ISO-POINCARE SUBGROUP
Tsu Yao Jun. 1970 94 p refs
(Contract AT(30-1)-3829)
(NYO-3829-52) Avail: NTIS

The unitary irreducible representations (UIR) of SU(2,2), the covering group of the conformal group, are reduced with respect to an iso-Poincare subgroup, E(3,1). Explicit representations of the 15 generators of SU(2,2) in terms of differential operators in the given function spaces are given. The matrix elements between a basis vector in the maximal compact subgroup SU(2) × SU(2) × U(1) and a basis vector in E(3,1) are calculated for all 14 different classes of UIR of SU(2,2). It is found that two classes are reducible with respect to light-like representations, four classes are reducible with respect to time-like representations, and eight classes are reducible with respect to space-like representations of E(3,1). Author (NSA)

N71-14184*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
AN EXAMINATION OF SIMPLE COORDINATE TRANSFORMATIONS IN THE Z-PLANE AND W-PLANE FOR ROOT LOCUS ANALYSIS OF SAMPLED-DATA SYSTEMS
Joseph S. Kazoil, Jr. Apr. 1970 15 p refs
(NASA-TM-X-66513; PM-104) Avail: NTIS CSCL 12A

Simple transformations of the Z-plane and W-plane coordinates to S-plane coordinates are examined in an attempt to facilitate root locus analysis of sampled-data systems. First, constant damping ratio, constant damping factor, and constant frequency loci are mapped onto the Z-plane and W-plane. From these, sampling frequency boundaries are specified wherein interpretation in the Z-plane or W-plane becomes identical to that in the S-plane. The implication is a savings in the analysis time if the system frequencies of interest are within the specified boundaries. Although the sampling frequency limit in the Z-plane is too large for practical considerations, that in the W-plane appears low enough to warrant its usefulness. Author

N71-14242# Northeastern Univ., Boston, Mass.
A STUDY OF CHIRAL SU(2) X SU(2) CURRENT ALGEBRA MODELS
Michael T. Vaughn Sep. 1970 32 p refs
(Grant NSF GP-12396)
(NUB-2029) Avail: Issuing Activity

The smoothness assumptions of the chiral SU(2) × SU(2) hard pion current algebra method are examined in detail. A new model, the current smoothness model, emerges as a plausible alternative to the standard hard pion model of Schnitzer and Weinberg, and others. The two models give satisfactory predictions for the decay A1 yields rho-meson + pion, but quite different predictions for the decay A1 yields pion + gamma and the colliding beam reaction positron electron yields A1 (+ or −) pion (− or +). Other possible models are also discussed. Author

N71-14273# Dublin Inst. for Advanced Studies (Ireland).
DIFFERENTIAL FORMS IN GENERAL RELATIVITY
W. Israel 1970 106 p refs /ts Commun., Ser. A, No. 19
Avail: NTIS

Differential forms are used to introduce users, with a limited background in relativity, to modern techniques in gravitational theory. Examples and step by step calculations are given including theorems and proofs. E.H.W.

N71-14284# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.
ORDERING FUNCTIONS IN MOEBIUS PLANES AND THEIR RELATIONSHIPS TO ALGEBRAIC GROUPS [ORDNUNGSFUNKTIONEN IN MOEBIUSEBENEN UND IHRE BEZIEHUNGEN ZU ALGEBRAISCHEN ANORDNUNGEN]
Hans-Joachim Kroll (Ph.D. Thesis) 1970 72 p refs In GERMAN
Avail: NTIS

Axiomatic studies on ordering in Moebius surface planes consider ordering functions of affinitive and projective geometry to derive spacing symbols or intermediate functions. Ordering functions are obtained for Moebius surfaces M(K,Q) through a commutative space K with zero division quadratic form Q(x,y). It is shown that each half-ordering of the space K induces an ordering function of M(K,Q) and that for the case K>2 each half-order of K is induced by exactly two ordering functions of M(K,Q). Also shown is that an ordering function of M(K,Q) is exactly normal if the corresponding half-order of K is: Q(x,y) > 0 for all (x,y) elements of (K times K)/((0,0)). The following conditions exist in a Euclidean surface with normal ordering functions: (1) there is a point W, so that for each circle k and each point A positioned on the same side of k as W, an existing circle through A and W touches k; and (2) if two points A,W are positioned on different sides of a circle k, then each circle through A,W sections the circle k. Transl. by G.G.

N71-14288# Rome Univ. (Italy). Istituto Matematico.
REVIEW OF SOME RESULTS CONCERNING APPROXIMATION OF SOME PHYSICAL CONSTANTS Final Scientific Report, 1 Feb. 1969 – 28 Feb. 1970
Gaetano Fichera 28 Feb. 1970 9 p refs
(Contract EOOAR-0060-69)
(AD-712077; ARL-70-0062) Avail: NTIS CSCL 12/1

Work done under Grant EOOAR-69-0060 is summarized. It concerns approximation of some physical constants (eigenvalues and electrostatics capacity). A method for decomposing the vector space of 3-vector valued functions on a cube into subspaces, which are invariant for the elasticity operator, is given. A method for the computation of orthogonal invariants is expounded. The electrostatics capacity of closed surface is numerically approximated. Author (TAB)

N71-14289# Technische Hochschule in Wien (Austria). Inst. fuer Numerische Mathematik.
DISCRETIZATION METHODS FOR DIFFERENTIAL EQUATIONS Final Scientific Report, 1 Jul. 1968 – 30 Jun. 1970
Hans J. Stetter 21 Sep. 1970 11 p refs
(Contract AF 61(052)-960)
(AD-712711; AFOSR-70-2482TR) Avail: NTIS CSCL 12/1

The report summarizes the research under the Contract. The main emphasis was on stability regions of discretization methods for ordinary differential equations. Results were also obtained in the following areas: Stability and monotonicity properties of discretizations of two-point boundary value problems; Systematic Richardson extrapolation applied to the solution of stiff systems of differential equations; Methods of characteristics for hyperbolic differential equations; and, Nonlinear instability phenomena. Author (TAB)

N71-14308# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
NUMERICAL STABILITY IN PROBLEMS IN LINEAR

ALGEBRA

Ivo Babuska Jun. 1970 33 p refs Presented at the SIAM Natl. Meeting, Denver, 29 Jun.–1 Jul. 1970
(Contract AT(40-1)-3443; Grant NSF GU-2061)
(ORO-3443-28; BN-663; CONF-700617-1) Avail: NTIS

Numerical stability in linear algebra problems are investigated with respect to special classes of matrices encountered when solving problems of mathematical analysis. After considering general notions of stability, the finite difference method is applied in solving a system of linear equations with tridiagonal matrix. R.B.

N71-14325# Technische Hochschule Hannover (West Germany).
A CONTRIBUTION TO THE DETERMINATION OF THE PROBABILITY DENSITY DISTRIBUTION FUNCTION IN STOCHASTIC PROCESSES WITH THE HELP OF QUASI-MOMENTS [EIN BEITRAG ZUR BESTIMMUNG DER WAHRSCHEINLICHKEITSDICHTE-VERTEILUNGSFUNKTION STOCHASTISCHER PROZESSE MIT HILFE DER QUASIMOMENTE]
Herward Schwarze (Ph.D. Thesis) 1969 19 p refs In GERMAN
Avail: NTIS

Design and construction of a measuring apparatus for determining one-dimensional probability density distribution functions of stochastic control processes are described. The measurement method is based on the development of Gram–Charlier series from an orthogonal polynomial function system that contains a Gaussian weight function. A coefficient system of quasi-moments is developed from the series by using function generators containing Hermite polynomials. Distribution density synthesis from measured quasi-moments is electronically feasible up to four times of the scattering value and can be imaged on an oscillographic surface. Example calculations for a Gaussian noise and a sinus-shaped statistical process are given. Transl. by G.G.

N71-14355# Intermountain Forest and Range Experiment Station, Ogden, Utah.
MATCHACURVE-1 FOR ALGEBRAIC TRANSFORMS TO DESCRIBE SIGMOID- OR BELL-SHAPED CURVES
Chester E. Jensen and Jack W. Homeyer 1970 26 p
(PB-192315) Avail: NTIS CSCL 12A

Graphed curves of the sigmoid- or bell-shaped classes can be scaled to and compared with the wide array of standard curves presented in this paper. If a standard can be found that suitably matches the graphed curve, the algebraic form specified for the standard can be fitted to any relevant data set by least squares. Algebraic forms utilized are all ratios of exponential functions. Author (USGRDR)

N71-14365# Illinois Univ., Urbana. Dept. of Physics.
INEQUALITIES ON DOUBLE PARTIAL WAVE AMPLITUDES FROM POSITIVITY, ANALYTICITY AND CROSSING SYMMETRY
Martin L. Griss Dec. 1970 30 p refs Supported in part by the Council for Sci. and Ind. Res. of S. Africa
(Grant NSF GP-25303)
Avail: Issuing Activity

Using geometrical inequalities similar to those of Martin for the partial waves of the pion(0) pion(0) amplitude in the Mandelstam triangle, we derive sets of inequalities, following from positivity and analyticity alone, and involving only a finite number of the Balachandran double partial wave amplitudes. Application of crossing symmetry gives further inequalities. Similar inequalities are obtained from the more constraining positivity-analyticity inequalities for the partial waves, given by Yndurain. Author

N71-14370# Stanford Univ., Calif. Dept. of Statistics.
FINDING A SINGLE DEFECTIVE IN BINOMIAL GROUP-TESTING
Satindar Kumar and Milton Sobel Aug. 1970 29 p refs
(Contract N00014-67-A-0112-0052)
(AD-712759; SU-TR-131) Avail: NTIS CSCL 12/1

The problem of finding a single defective item from an infinite binomial population is considered when the group-testing is possible, i.e., when one can test any number of units x simultaneously and find if all x are good or if at least 1 of the x defective is present. An optimal procedure is obtained in the sense that it minimizes the expected number of tests required to find one defective. Upper and lower bounds are derived using information theory. The relation of the procedure to the Huffman algorithm and the corresponding cost is studied. Author (TAB)

N71-14383# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ASYMPTOTICALLY EFFICIENT ESTIMATION BY LOCAL LOCATION-PARAMETER APPROXIMATIONS
D. S. Moore Aug. 1970 23 p refs *Its* Mimeograph Ser. No. 239
(Contract Nonr-1100(26); Grant NSF GP-06073)
(AD-712487) Avail: NTIS CSCL 12/1

It is well known that there exist asymptotically efficient estimators for regular location parameter families. Linear combinations of order statistics may be used. Fraser observed that if F(x, theta) is any regular stochastically increasing family of distributions and theta sub 1 any fixed parameter value, a transformation S(./theta sub 1) exists such that the transformed random variable has approximately a location parameter distribution for theta near theta sub 1. One can therefore estimate theta by using an inefficient but consistent estimator theta prime sub n, applying the transformation S(./theta prime sub n) to the observations and using the A(E sup n) estimator for the approximating location parameter family. It is shown that this procedure is asymptotically efficient and an example of its use is given. Author (TAB)

N71-14384# Stanford Univ., Calif. Dept. of Statistics.
A TWO-SAMPLE SEQUENTIAL TEST WITH ONE SAMPLE-SIZE FIXED
Paul Switzer 29 Jul. 1970 31 p refs
(Contract N00014-67-A-0112-0053)
(AD-712755; TR-158) Avail: NTIS CSCL 12/1

When two populations must be sampled at different times, one cannot test for shift using the standard sequential probability ratio test based on paired observations. However, it is still meaningful to obtain the later sample sequentially. A test for shift with one sample-size fixed and the other sample size random is proposed, some of its properties are developed under normal theory assumptions, and a comparison is made with the completely fixed sample-size procedure. Author (USGRDR)

N71-14396# Stanford Univ., Calif. Dept. of Operations Research.
MINIMAX INVENTORY AND QUEUEING MODELS
Edmund M. Notzon, III 30 Aug. 1970 69 p refs
(Contract N00014-67-A-0112-0050)
(AD-712770; TR-17) Avail: NTIS CSCL 12/2

The paper studies inventory and queueing models. It frequently focuses on a situation in which the relevant distribution functions are unknown. Instead, known are the classes from which these distribution functions can be chosen by nature. If one knows the relevant distribution functions one can seek decision policies that minimize the expected cost. Otherwise one seeks decision policies that minimize the maximum expected cost to be incurred, this maximum being taken over all possible distribution functions. This second criterion is referred to as the minimax criterion. In Chapter II the report proves minimax analogs to Scarfs and Veinotts well-known results on the optimality of (s,S) ordering policies for inventory models. In addition slightly weakened are the ordering they impose on the fixed charges. In Section 4 of Chapter II the report assumes that the sequences of demands for an inventory model are chosen by nature from a compact set so that as demands become known, the class of future possible sequences of

demands is restricted. The object is to utilize this information in determining an optimal policy. Thus one has a non-Bayesian learning procedure. Author (TAB)

N71-14398# Harry Diamond Labs., Washington, D.C.
A FORTRAN PROGRAM FOR OBTAINING APPROXIMANTS TO REAL-VALUED FUNCTIONS
Nick Karayianis Jun. 1970 71 p
(AD-712973; HDL-TR-1490) Avail: NTIS CSCL 12/1

A FORTRAN program is described by which systematically better approximants to a given real-valued function f(T) over 0 = or < T = or < infinity can be obtained. The program automatically generates these approximants once the user has provided the first K coefficients of the small T expansion for f(T) and the first M coefficients of the large T expansion. A punched FORTRAN deck for the desired approximant to f(T) is generated. Author (TAB)

N71-14481# Wisconsin Univ., Madison. Dept. of Statistics.
MULTIPARAMETER DIFFERENTIATION IN QUADRATIC MEAN AND ASYMPTOTICALLY OPTIMAL TESTS FOR SOME FAILURE DISTRIBUTIONS
Bruce Lind and George Roussas Mar. 1970 59 p refs
(Grant NSF GP-11890)
(PB-192459; UWIS-DS-70-227; TR-227) Avail: NTIS CSCL 12A

In recent papers results on contiguous sequences of probability measures have been applied to the problem of finding asymptotically optimal tests in a certain class of Markov processes which are dependent on a vector-valued parameter and satisfy certain regularity conditions. One of the regularity conditions imposed on the processes is the differentiability in quadratic mean of a certain random function, defined on the process and dependent on the vector-valued parameter, with respect to a vector-valued argument. A theorem is proved which is useful in the determination of such quadratic mean derivatives. The second purpose is to determine asymptotically optimal tests of hypotheses about the parameters of the gamma, Weibull (2-parameter), modified extreme value, log-normal and normal distributions. These distributions are of importance in reliability theory as failure distributions. USGRDR

N71-14484# Pennsylvania Univ., Philadelphia. Dept. of Physics.
SELF-ADJOINT ALGEBRAS OF UNBOUNDED OPERATORS
Robert T. Powers Jul. 1970 15 p refs
(Contract AT(30-1)-2171)
(NYO-2171-318) Avail: NTIS

Some results concerning self-adjoint algebras of unbounded operators in the Wightman formulation of quantum field theory are presented. It is hoped to present the beginnings of an analysis of algebras of unbounded operators. NSA

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-13942# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
FINE SCALE STRUCTURE OF ATMOSPHERIC TEMPERATURE MEASURED WITH A CONTINUOUS RECORDING SONDE
H. Mantis and T. Pepin Sep. 1970 29 p refs
(Contract N00014-67-A-0113-0004)
(AD-712521; AP-35) Avail: NTIS CSCL 4/2

An experimental sonde to measure fine scale temperature structure of the upper atmosphere is described and the results of an inter-comparison of this instrument with the Weather Bureau temperature sonde is presented. Analysis of the temperature structure observed with the new sonde indicates that the initial subrange in the free atmosphere must be limited to vertical scales no larger than 80 meters. Author (TAB)

N71-14087# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: MEDITERRANEAN MARINE AREAS. VOLUE 9: AREA 32: SOUTH CYPRUS, AREA 33: NILE DELTA, AREA 34: BEIRUT, AREA 35: PORT SAID
Oct. 1970 1446 p
(AD-712761) Avail: NTIS HC$10.00/MF$0.65 CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The report contains weather observations from the Mediterranean Sea area. TAB

N71-14117# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 68, NO. 4, WEATHER SATELLITE OBSERVATIONS AND THEIR EVALUATION. THE EUROPEAN CLIMATOLOGY 1968 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 98, HEFT 4: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD 1968. TEIL 4, 4. VIERTELJAHR]
Ingrid Haupt, Horst Malberg, et al 1970 509 p In GERMAN; ENGLISH summary
(QR-4) Avail: NTIS

Weather satellite data for observations in Berlin are reported for the fourth quarter of 1968. The launch of ESSA 8 and the snow and ice conditions in the European area for the period October to December 1968 are considered. Daily European climatology of the last quarter of 1968, the respective orbital data of ESSA 6 and ESSA 8, and special data for the APT pictures taken in Berlin are presented. Author

N71-14169*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A METEOROLOGICAL REPORT FOR THE MOUNT HOPKINS OBSERVATORY: 1968–1969
Michael R. Peerman, Donald Hogan, Werner Kirchhoff, Kenneth Goodwin, DeWayne Kurtenbach et al 26 Oct. 1970 40 p ref
(Contract NAS12-2129)
(NASA-CR-111740; SAO-Special-Rept-327) Avail: NTIS CSCL 04B

Weather data collected at the Mt. Hopkins Observatory in Arizona during 1968 and 1969 are presented. The meteorological parameters, and the seasonal weather patterns are summarized. F.O.S.

N71-14171*# Virginia Polytechnic Inst., Blacksburg.
MEASUREMENT OF THE GROUND WIND STRUCTURE Semiannual Status Report
Dec. 1970 31 p
(Grant NGL-47-004-067)
(NASA-CR-115772) Avail: NTIS CSCL 04B

Progress is reported in an aircraft vortex study as a major effect of the ground wind measurement research program. The two part study consists of the following: (1) An experimental vortex investigation was initiated to better understand the basic nature of an aircraft wing-tip vortex. Preparations were made for wind tunnel calibration and evaluation tests on a three dimensional hot-wire anemometer system being developed in the project. (2) A theoretical vortex investigation was begun in an effort to obtain a numerical solution to the Navier–Stokes equations for the trailing vortex as

a whole. The proposed method for solution consists of treating the problem essentially as an incompressible boundary layer problem. D.L.G.

N71-14181 Illinois Univ., Urbana.
THE ROLE OF COLLECTION IN DETERMINING RAINDROP SIZE DISTRIBUTIONS
John Robert Adam (Ph.D. Thesis) 1969 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-775

The rate of collection of small raindrops by large raindrops was determined experimentally and the effect of droplet growth by collection on the raindrop size distribution was calculated. The experimental measurements were made using droplets produced by a Rayleigh generator. An inherent aerodynamic instability in the droplets produced by this generator was analyzed and a means of suppressing this instability was developed. The deceleration rates for droplets in the size range from 3 millimeters to 30 microns diameter were measured, and agree with theoretically calculated deceleration rates which assume that the standard steady-state drag coefficient versus Reynolds number relation was applicable. The collision efficiencies for droplets in the size range from 3 millimeters to 740 microns diameter were measured and found to be unity independent of droplet charge. A computer simulation of rainfall leaving a warm cloud was made. The droplet size distributions, radar reflectivities, and liquid water contents of rainfall were calculated as a function of rainfall rate and fall distance from cloud base. Dissert. Abstr.

N71-14216# Denver Research Inst., Colo.
A STUDY OF THE PRODUCTION AND DETECTION OF ARTIFICIAL ICE NUCLEI Final Report
Norihiko Fukuta, L. F. Evans, Young H. Paik, William A. Schmeling, and Louise A. Walter Jul. 1970 20 p refs
(Contract Di-14-06-D-6444)
(PB-194129; DRI-2547) Avail: NTIS CSCL 04B

The present major task of weather modification engineering is the optimization of the seeding effect which depends on the purpose of seeding and the type and condition of the given cloud system. Toward this objective, a study of many subjects was carried out concerning the production and detection of ice nuclei, and growth of the formed ice crystals. Major achievements are as follows: development of organic ice nuclei generators, airborne volatile liquid ice crystal generstors, a slow activation ice nucleus counter, and ice crystal growth theory from vapor. Author (USGRDR)

N71-14274# Scott Research Labs., Inc., Plumsteadville, Pa.
ATMOSPHERIC REACTION STUDIES IN THE LOS ANGELES BASIN. PHASE 2: DATA ANALYSIS AND METHODS IMPROVEMENT Atmospheric Report, 22 Aug.–14 Nov. 1968
7 Mar. 1970 79 p refs
(Contract PHS-CPA-22-69-19)
(PB-194060) Avail: NTIS CSCL 13B

Aerometric data collected in the Los Angeles Basin during the fall of 1968 were analyzed to study the relationships among the chemical and meteorological parameters measured. Emphasis was placed on defining the formation rates of the products of atmospheric chemical and photochemical reactions, especially nitrogen dioxide and ozone. The study was concentrated on the empirical relationships which connect the outputs of the atmospheric system for example, the photochemical products, to the inputs represented by pollutant emissions and ultraviolet radiation. The concentrations of many contaminants followed similar diurnal patterns. The work dealing with improvement of methods applicable to atmospheric analysis concentrated on techniques for atmospheric nitrogen compounds, hydrocarbons, nitrogen oxides and oxidants. Author (USGRDR)

N71-14275 Freie Univ., Berlin (West Germany). Inst. for Meteorology and Physics.
METEOROLOGICAL DATA. VOLUME 114, No.1: DAILY GROUND AND 850-mb MAPS OF THE NORTHERN HEMISPHERE IN 1970. PART 1: FIRST QUARTER [METEOROLOGISCHE ABHANDLUNGEN: BAND 114, HEFT 1: TAEGLICHE BODEN-UND 850-MB-KARTEN DER NORDHEMISPHAERE IM JAHRE 1970. TEIL 1: VIERTELJAHR]
Manfred Geb, Richard Scherhag et al 1970 97 p In GERMAN
Avail: Issuing Activity

Meteorological Data: Volume 114, No. 1. Daily Ground and 850 mb Maps of the Northern Hemisphere in 1970. Part 1, First Quarter - Manfred Geb, Richard Scherhag et al -Institute for Meteorology and Geophysics, Freie Univ. Berlin. Daily ground and 850 mb maps are presented for the Northern Hemisphere for the period 1 January to 31 March 1970. Transl. by R.B.

N71-14404# Comissao Nacional de Atividades Espaciais, Sao Jose dos Campos (Brazil).
BEHAVIOR OF THE LOWER ATMOSPHERE IN THE AREAS STUDIED FOR PROJECT SARE DURING JULY OF 1969 [COMPORTAMENTO DA BAIXA ATMOSFERA NAS AREAS DE TESTE DO PROJETO SERE EM JULHO DE 1969]
Linton Ferreira de Barros Jul. 1970 96 p refs In PORTUGUESE
(LAFE-122) Avail: NTIS

Meteorological data including ESSA 8 satellite data were analyzed for a selected test area in Brazil with emphasis on surface meteorological phenomena. It is concluded that zones of convergence can be determined by the satellite cloud pictures, and that sufficient data are available for accurate synoptic analysis. Skew T, Log P diagrams, and synoptic maps are included. F.O.S.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-13951# Stanford Univ., Calif. Dept. of Statistics.
SHIP TRACKING VIA SATELLITE: AN ERROR ANALYSIS
Peter J. Cooke 22 Jul. 1970 22 p ref
(Contract N00014-67-A-0112-0053)
(AD-712756; TR-157) Avail: NTIS CSCL 17/7

Under the assumption of complete ephemeris information about a satellite orbiting the earth, a ship wishes to estimate its location and velocity using only range readings of the ship-to-satellite distance at various times. An error analysis is carried out for Gelfand's method 3. Satisfying results were obtained for estimates of location, but not for velocity. Tables are appended. Author (USGRDR)

N71-13958* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITION LOCATION SYSTEM AND METHOD Patent
Charles R. Laughlin and Roger C. Hollenbaugh, inventors (to NASA) Issued 10 Feb. 1970 (Filed 30 Jan. 1968) 22 p Cl. 343-112; Int. Cl. G01s5/12
(NASA-Case-GSC-10087-2; US-Patent-3,495,260; US-Patent-Appl-SN-701744) Avail: US Patent Office CSCL 17G

A system for determining the position of moving objects, deriving centralized air traffic control data, and communicating via voice and digital signals is examined. The system operates between remote aircraft supersonic transports, and central and peripheral ground stations through a synchronous satellite relay station. Drawings illustrate examples for working the relay system. E.H.W.

N71-14050*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

[STATE ESTIMATION ERRORS IN NAVIGATIONAL STATE ESTIMATION PROBLEM] Quarterly Progress Report, 1 Feb.–1 May 1969

25 Apr. 1969 44 p refs

(Contract NAS9-9024)

(NASA-CR-108708; REPT-69-341L-1; QPR-1) Avail: NTIS CSCL 22A

A scheme for assuring that the covariance matrix of state estimation errors used in the navigational state estimation problem remains greater than or equal to the true covariance matrix is presented. A formal proof of the important properties of this scheme is included. Some representative results are given from a simulation of the use of this scheme on an earth orbital mission. An approach is described to the problem of improving the estimate of the state of a vehicle which is on an orbital mission about a parent body whose gravitational anomalies are initially unknown. Author

N71-14055*# Techtran Corp., Glen Burnie, Md.

KINEMATICS OF INERTIAL NAVIGATION SYSTEMS

M. I. Zakharin et al Washington NASA Dec. 1970 238 p refs Transl. into ENGLISH of the book 'Kinematika Inertsialnykh Sistem Navigatsii' Moscow, Mashinostr., 1968 p 1–234

(Contract NASw-1695)

(NASA-TT-F-614) Avail: NTIS CSCL 17G

In the problem of automatic flight control, an important place is occupied by the determination of the instantaneous values of the kinematic parameters of the motion of an aircraft with respect to a chosen system of calculation. In order to solve this problem navigational systems may be employed in which operation is based on various physical principles. Methods are examined for determining the instantaneous values of the parameters of aircraft by means of inertial navigation systems, based on the independent measurements of absolute acceleration of movement with subsequent consideration for the gravitational field in which the flight is being accomplished. Author

N71-14132* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SPACECRAFT EXPERIMENT POINTING AND ATTITUDE CONTROL SYSTEM Patent

Peter R. Kurzhals, inventor (to NASA) Issued 3 Feb. 1970 (Filed 27 Jul. 1967) 11 p Cl. 244-1; Int. Cl. B64G1/00

(NASA-Case-XLA-05464; US-Patent-3,493,194; US-Patent-Appl-SN-656995) Avail: US Patent Office CSCL 17G

A spacecraft experiment pointing and attitude control system is discussed. A double-gimbaled moment gyro unit is mounted along each of the three orthagonal axes of the spacecraft. Each unit has an inner and an outer gimbal which are controlled by a control system to provide spacecraft stabilization. The control system senses movement of the spacecraft, analyzes the movement, and controls the application of power to the gimbals to compensate for the movement. In addition, the control system activates desaturation jets when the gyro units become saturated. P.N.F.

N71-14148*# Rensselaer Polytechnic Inst., Troy, N.Y.

A BODY-BOUND NAVIGATION SYSTEM, ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION

Alan L. Goldberg and Paul Frankel Jun. 1970 47 p refs

(Grant NGL-33-018-091)

(NASA-CR-111737; RPI-MP-17) Avail: NTIS CSCL 17G

A requirement for an unmanned Martian roving vehicle is an autonomous onboard navigation system. One necessity of such a system is to erect a reference coordinate frame and relate any subsequent motion to this frame. The instrumentation decided upon to erect a local vertical, ergo a reference coordinate system, was two body mounted two-degrees-of-freedom gyroscopes. The outputs of the gyroscopes, when used in conjunction with the components of acceleration of the rover, are a set of sufficient conditions to completely specify the vehicle's Euler angle rotation and translation from the initial reference frame. Developed are the necessary equations of motion of a two-degrees-of-freedom gyroscope where large angular excursions occur, the relationships between the various coordinate frames employed, and the translational equations of motion of the rover itself. Author

N71-14158*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE STABILITY AND PERFORMANCE CHARACTERISTICS OF AN EARTH-ORIENTED GIMBALED-REACTION-WHEEL-SCANNER CLASS OF SPACECRAFT

H. Richard Freeman (Ph.D. Thesis—Maryland Univ., May 1970) Washington Nov. 1970 228 p refs

(NASA-TR-R-354; G-996) Avail: NTIS CSCL 22A

The performance characteristics of the general class of earth-oriented spacecraft controlled by a gimbaled-reaction-wheel-scanner attitude-control system are presented. Stability thresholds are analytically determined for this general class of vehicle in terms of its six system parameters. System stability in the presence of periodically varying pitch-momentum bias is considered, and a technique is established for the analysis of the general linearized equation set when it contains periodically time-varying coefficients. A comprehensive numerical study is performed, and the study concludes with an attempt at the analytic determination of stability thresholds for a system with a variational pitch-momentum bias. Also considered is system performance in the presence of a realistic disturbance torque model. A factor-of-merit function is established, and a method is presented that allows a potential user the means of choosing a "best" set of system parameters from a large six-dimensional array of possible parameters. The validation of the results obtained using a linearized time-invariant equation set is reported. The validation procedure makes use of linear and nonlinear digital computer simulations and the Floquet stability criterion technique. Author

N71-14159* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ATTITUDE CONTROL SYSTEM Patent

Clarence Cantor and Frank A. Volpe, inventors (to NASA) Issued 20 Jan. 1970 (Filed 24 Jan. 1968) 6 p Cl. 244-1; Int. Cl. B64g1/20

(NASA-Case-XGS-04383; US-Patent-3,490,719; US-Patent-Appl-SN-700142) Avail: US Patent Office CSCL 17G

A system for controlling the pointing of a space vehicle is described. An inertially-referenced attitude control system (IACS) is combined with a stellar or solar attitude control system (SACS) to form a fine attitude control system (FACS). Initially, coarse jets under the control of the IACS roughly point the space vehicle toward the desired target. Later, the fine sensor of the SACS is used to correct the errors in the coarse reference and simultaneously to point the vehicle closer to the target. Fine jets under the control of the SACS accurately point the vehicle at the target and maintain the fine pointing. P.N.F.

N71-14303*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

GUIDANCE AND CONTROL CONSIDERATIONS FOR ADVANCED MANNED SPACE MISSIONS

R. A. Gardiner and G. Xenakis Nov. 1970 19 p refs Presented at Inst. of Navigation Nat. Space Meeting, Houston, Tex., April 1969

(NASA-TM-X-58063) Avail: NTIS CSCL 17G

The directions that future manned navigation, guidance and control developments are likely to take are explored. The scope of these future developments is shown to be encompassed by the

types of space transportation systems to be used and the objectives of the exploration bases to be developed. The requirements for an earth orbital exploration base and its supporting logistics shuttle are considered in the context of our past experience and the unique requirements of the future. It is shown that we will be transitioning from programs that are principally developmental in nature, to programs which are more operationally conditioned. This fact, coupled with the resulting longer duration missions, indicates a need for a reconsideration of our manned navigation, guidance and control system approaches. Author

N71-14342# Coast Guard, Baltimore, Md. Field Testing and Development Center.
TESTS OF LUNDY CR-10 DIGITAL COMPASS Final Report
W. E. Newland 25 Sep. 1970 20 p
(AD-712547; USCG-515) Avail: NTIS CSCL 17/7

The Lundy Electronics and Systems, Incorporated has developed a digital magnetic compass designed primarily for small boat use. This report describes some simple tests made upon this Hall-effect magnetic compass. These tests were designed to provide some indication of the dynamic performance of this compass. Author (TAB)

N71-14343# Naval Research Lab., Washington, D.C.
A PROBABILITY DENSITY FUNCTION FOR THE FUTURE POSITION OF A VESSEL AT SEA Interim Report
M. E. B. Owens 26 Aug. 1970 14 p refs
(AD-712506; NRL-7128) Avail: NTIS CSCL 17/7

A probability density function was derived which can be used to calculate the probability that the future of a vessel at sea will be in a given region. The density function was derived for the following conditions: at the initial time the actual position of the vessel is a sample from a normal distribution with known mean and covariance matrix; the velocity of the vessel remains constant during the time period of interest; the speed of the vessel is a sample from a chi distribution; and the course of the vessel is a sample from an arbitrary distribution. Author (TAB)

N71-14373# Naval Research Lab., Washington, D.C.
TWO-DIMENSIONAL POINT RESOLUTION
M. E. B. Owens and J. H. Kullback 11 Sep. 1970 13 p
(AD-712508; NRL-7122) Avail: NTIS CSCL 15/4

A hypothesis test has been designed for a situation which arises when multiple sensors observe the positions and only the positions of vessels in a specified region of the ocean. Given that two sensors each observe the position of a vessel, the problem is to determine whether the sensors observed the position of the same vessel or the positions of different vessels. Assuming the observations occur at the same time and the observation errors are normally distributed with known covariance matrices, it is a simple matter to design a test to test the null hypothesis that the observations refer to the same vessel against the alternative hypothesis that the observations refer to different vessels. This test is designed to have a fixed but arbitrary probability of the type 1 error (concluding that the observations refer to different vessels when they actually do not). Remaining is the question of the probability of the type 2 error (concluding that the observations refer to the same vessel when they actually do not). Without a complete statistical description of the processes, one cannot answer this question exactly. The authors have only assumed that the number of vessels in any subregion is a Poisson random variable having for the parameter the product of a constant and the area of the subregion, the constant being the expected number of vessels per unit area. Under this condition the least upper bound for the probability of the type 2 error is expressed as an explicit function of the error covariance matrices, the probability of the type 1 error, and the expected number of vessels per unit area. Author (TAB)

N71-14425*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LABORATORY AND FIELD TESTS OF A LUNAR SURFACE NAVIGATION SYSTEM
Bobby F. Walls, William C. Mastin, and Peter H. Broussard, Jr. 28 Aug. 1970 24 p refs
(NASA-TM-X-64551) Avail: NTIS CSCL 17G

The results of laboratory and field tests on a simple dead reckoning system that consists of a directional gyro, an odometric system, and a signal processor are presented. Navigation sorties of lengths of 30 km are described, and the results are given in detail. The use of a sun aspect compass for initial gyro alignment is described. The results of these tests offer strong corroborative proof that such a system is adequate for the initial manned lunar sorties. Author

N71-14492*# General Electric Co., Schenectady, N.Y. Research and Development Center.
ATS RANGING AND POSITION FIXING EXPERIMENTS Periodic Progress Report, 1 Aug. – 31 Oct. 1970
31 Oct. 1970 25 p refs
(Contract NAS5-11634)
(NASA-CR-115782; S-70-1107) Avail: NTIS CSCL 17G

Ranging tests with the transponders in the North Atlantic are discussed with the successful testing of the VHF SATCOM equipment by two-satellites. The occurrences of ionospheric scintillation during this period are reported. The effects of sea reflection multipath on position fixes determined by range measurements from two satellites were also tested, and the results are summarized in tables. It is concluded that the test results indicate a position fix accuracy of one nautical mile within range distances of 900 nautical miles. F.O.S.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-13559# Oak Ridge National Lab., Tenn.
CALCULATION OF THE FLUX IN A SODIUM RESERVOIR
Shlomo Katz et al [1970] 20 p Transl. into ENGLISH from French report CEA-N-1253 Sponsored by AEC
(ORNL-tr-2354; CEA-N-1253) Avail: NTIS

Calculations are made of the different responses given by detectors (S, Rh, N, Cd) in the model of the lower shielding of Phenix placed in the reactor Harmonie using the code Tripolo. The calculation methods make use of sources placed at the entrance of the model. The case considered is a simple one but is typical of the majority of the possibilities offered by the three-dimensional multikinetic Monte-Carlo code Tripoli. Experimental results and calculations of spherical geometry using the code Niobe are also available. Author (NSA)

N71-13560# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CYTHERE CODE: KINETICS OF THE SECONDARY WATER-STEAM CIRCUIT OF A GAS-COOLED NUCLEAR REACTOR
Jean-Claud Rousseau, Pierre Barber, Michel Dobremelle, and Bernard Villard Jun. 1970 43 p refs In FRENCH
(CEA-R-4012) Avail: AEC Depository Libraries

A numerical method is presented for calculating the transient phenomena in the secondary water-steam circuit of a gas-cooled nuclear reactor. The basis of this method is to consider the space and

the time discreetly. The partial derivative equations representing the conservation of energy, of mass, and of momentum are then replaced by finite difference equations. This calculation code is compared to test results obtained with the prototype of a steam generator designed for a gas-graphite reactor. It appears that the code explains perfectly well the changes in all the physical parameters of the primary and secondary fluids for regimes in which occur sudden and large changes of the conditions. Author (NSA)

N71-13561# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

GAMMA RADIATION ATTENUATION STUDY: N 16 LOOP. COMPARISON OF EXPERIMENTAL RESULTS WITH CALCULATION [ETUDE DE L'ATTENUATION DES GAMMA: BOUCLE A AZOTE 16. COMPARAISON ENTRE LE CALCUL ET L'EXPERIENCE]

Claude Dupont, Aime Jean, and Yves Oceraies Aug. 1970 43 p refs In FRENCH

(CEA-N-1331) Avail: AEC Depository Libraries

An attempt was made to check the methods of calculation used for determining the thickness of the secondary shielding of water cooled reactors. The nitrogen 16 loop situated in the reactor Triton was considered as being a schematic representation of the complex circuits of these reactors. Author (NSA)

N71-13562# Institutul de Fizica Atomica, Bucharest (Rumania).

CONTRIBUTIONS TO THE DESIGN AND DEVELOPMENT OF ELECTRON LINEAR ACCELERATORS [CONTRIBUTIONS A L'ETUDE ET LA REALISATION DES ACCELERATEURS LINEAIRES D'ELECTRONS]

1969 234 p refs In FRENCH

(NP-18317; AL-1/1969) Avail: AEC Depository Libraries

Included are the 3-MeV electron linear accelerator, calculations for the structure of the 3-MeV electron linear accelerator, technology of the accelerator guide, variable mode transitions, the Teflon joint, power load in the S band, modulation of the magnetron, and the electron gun. Injection modulation, the focusing system for the linear accelerator, the quadrupole magnet system for the 3-MeV electron linear accelerator, the electronic system for the programming of beam parameters, and the accelerator control system are discussed. Also included are the ferrite torus traneducer for measuring the beam momentum, a device for studying the current density distribution in the electron beam, determination of the phase and group velocity of electromagnetic waves in the iris guide, the perturbation method for measuring the relative amplitude of the accelerator electric field, and an experimental study of the characteristics of the accelerator operation. NSA

N71-13563# Nuclear Energy Information Center, Warsaw (Poland).

PRESSURIZED WATER POWER REACTORS: BIBLIOGRAPHY, 1957 – 1968

A. Kowalski, comp. 1970 283 p refs

(NEIC-RR-39) Avail: AEC Depository Libraries

Included are 3053 references on pressurized water power reactors. The references were obtained from Nuclear Science Abstracts for the period 1957 to 1968. Corporate author, report number, patent, subject, and reactor indexes are included. NSA

N71-13564# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

SHORT-TIME IRRADIATION EXPERIMENT IN THE STUDSVIK R-2 REACTOR. PROJECT CRITERIA: PARTIAL CALCULATIONS [ESPERIENZE DI IRRAGGIAMENTO A TEMPI BREVI NEL RETTORE R-2 DI STUDSVIK. CRITERI DI PROGETTO-CALCOLI PARZIALI]

A. Calza Bini, A. Nobili, P. Rataloni, and G. Testa 24 Feb. 1970 35 p refs In ITALIAN

(RT/ING-(70)6) Avail: AEC Depository Libraries

The short-time irradiation experiments to be carried out in R-2 Studsvik reactor under the plutonium program are described. The 27 first group samples are 5% W/O in Zr-2 cans (pellets and vibrocompacted power). A detailed description of the experiment and the expected in-pile behavior of the samples is presented. A comparison between the results obtained with both CNEN and AB Atomenergi calculation codes is given. Author (NSA)

N71-13565# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.

A FORTRAN 4 CALCULATOR PROGRAM FOR PREDETERMINATION OF THE CREEP COLLAPSE OF THIN WALLED TUBES [EIN FORTRAN-4-RECHENPROGRAMM ZUR VORAUSBESTIMMUNG DES KRIECHBEULVERHALTENS DUENNWANDIGER ROHRE]

G. Buerkle, H. Kaupa, and W. Schneider May 1970 14 p refs In GERMAN; ENGLISH summary

(NP-18354) Avail: AEC Depository Libraries

A computer program is reported, by which the creep buckling behavior of thin-walled tubes, for instance claddings for a steam or gas-cooled reactor, can be calculated. The basis of the program is a differential equation of the velocity of buckling. This equation is the result of Hoff's theory, which describes the buckling of tubes at high temperature under external pressures by means of a sandwich model. The calculation contains steady correction of the creep constant K according to Norton's creep law as it is used in Hoff's theory to get equal creep velocities, since the integration of the differential equation requires integer n-parameters. Printed results of the calculation are the life times of the tube until complete buckling or any grade of buckling for discrete steps of external pressure. Author (NSA)

N71-13566# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

HEAT TRANSFER IN A SIMULATED BWR FUEL BUNDLE COOLED BY SPRAY UNDER LOSS-OF-COOLANT CONDITIONS

J. D. Duncan and J. E. Leonard Jun. 1970 68 p refs Prepared for Idaho Nuclear Corp.

(Contract AT(10-1)-1230)

(GEAP-13086) Avail: NTIS

The ability of the core spray system to limit fuel rod cladding temperatures in the unlikely event of a loss-of-coolant accident has been investigated. Simulated loss-of-coolant transient tests were conducted with a full-scale, electrically heated, stainless steel-clad, fuel bundle mockup at atmospheric pressure. The temperature response of the bundle cladding was measured as a function of power level, initial temperature, and coolant spray flow rate. Convective heat transfer film coefficients were then calculated as a function of rod location in the bundle and time after initiation of spray cooling. A tentative physical description of the heat transfer mechanisms significant in spray cooling transients is presented. The results indicate that spray cooling is an effective heat transfer mechanism and that such a system is suitable for use as a standby cooling system to protect a BWR core in the event of a loss-of-coolant accident. Author (NSA)

N71-13567# Technische Univ., Berlin (West Germany). Inst. fuer Kerntechnik.

STATIONARY HEAT TRANSFER IN INFINITELY LONG, ECCENTRICALLY LAYERED CYLINDERS WITH POSITION-DEPENDENT HEAT SOURCES AND PERIPHERAL RESTRICTIONS. USE OF THE THERMAL

INTERPRETATION OF REACTOR FUEL ELEMENTS [STATIONAERER WAERMETRANSPORT IN UNENDLICH LANGEN, EXZENTRISCH GESCHICHTETEN ZYLINDERN MIT ORTSABHAENGIGEN WAERMEQUELLEN UND RANDBEDINGUNGEN. ANWENDUNG AUF DIE THERMISCHE AUSLEGUNG VON REAKTORBRENNELEMENTEN]

Lothar Wolf Apr. 1970 140 p refs In GERMAN; ENGLISH summary
(TUBIK-18) Avail: AEC Depository Libraries

Stationary 2-dimensional transfer problems in thermally coupled multilayer cylindrical systems can be solved analytically even for deviations from ideal coaxial arrangements for boundary conditions of the third type; heat transfer coefficients can be either constant or surface-dependent, heat sources can be homogenous or inhomogeneous within the various layers. Two cases are distinguished; first, relative eccentricity of all layers is equal and, second, relative eccentricity varies. Mathematical procedures are different and are described. The two procedures are used to calculate surface temperature of fuel elements. With the procedures, it is possible to solve important problems occurring at hot spots of fast breeder reactors. Because of their importance, carbide fuel elements are analyzed as to thermal behavior. The mathematical procedures are more complicated and time consuming than approximate procedures; however, they are far superior in accuracy. NSA

N71-13568# Kernforschungszentrum, Karlsruhe (West Germany). Inst. für Neutronenphysik und Reaktortechnik.

THEORETICAL TREATMENT OF CONCEIVABLE SERIOUS ACCIDENTS AT FAST BREEDER REACTORS IN THE CONTEXT OF THE BETHE-TAIT METHOD

F. G. Kluge et al 1970 75 p refs Transl. into ENGLISH from German report KFK-1057 Sponsored in part by EURATOM
(EURFNR-748; KFK-1057) Avail: NTIS

The maximum energy release following a large accident of the fast power reactor is usually calculated with the Bethe–Tait formalism. The version presented is adopted to spherical and to cylindrical geometries; the excursion calculations take account of the delayed neutrons and of the Doppler-feedback, including the fuel-melting process. A formalism for determining the destructive energy is also incorporated. Parameter calculations have been carried out to cover up the uncertainties in the initial values of the excursions; the results are presented and discussed. A critical survey on the main assumptions of the Bethe–Tait formalism has been added. Author (NSA)

N71-13602# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EXPERIMENTS IN THE REACTOR OSIRIS

Jun. 1970 201 p In FRENCH
(CEA-R-3991) Avail: AEC Depository Libraries

Since it was started up at the end of 1966, the swimming-pool research reactor OSIRIS has been used for numerous and varied irradiation experiments, which have necessitated the development of a certain number of specially adapted experimental devices. A brief summary is given of the main characteristics of the reactor from the point of view of its use for experiments; the general experience acquired over three years is then described, and an explanation given of the organization of the work involved for an experiment from the initial project up to the placing of the device in the reactor. A detailed description is given of the main irradiation devices available: simple capsules, such as those used for producing transuranic elements, temperature-controlled capsules fitted with instruments for carrying out creep tests or for following in-pile changes in certain characteristics of a sample, and complex loops with independent fluid circulation (mainly gaseous) reproducing the ambient conditions of power reactors. Author (NSA)

N71-13605# Argonne National Lab., Ill.

PRELIMINARY SYSTEM DESIGN DESCRIPTION OF THE EBR-2 FAILED-FUEL TRANSFER SYSTEM

C. J. Divona and E. Hutter Jul. 1970 27 p refs
(Contract W-31-109-eng-38; Proj. EBR-2)
(ANL/EBR-024) Avail: NTIS

The failed-fuel transfer system provides additional capability to remove subassemblies, which contain failed fuel, from the primary tank in the reactor building to the argon cell of the Fuel Cycle Facility (FCF). The major parts of the system are: a dipper with associated components, and a sealed container with a radiation shield. The dipper retrieves the subassembly from the transfer arm and acts as a temporary storage facility by keeping the subassembly inside the primary tank without impeding standard fuel-handling operations. The dipper containing the subassembly and sodium can be lifted through the X-nozzle plug into the sealed container. The sealed container is surrounded by a radiation shield in such a manner that the combined assembly can be transferred through the equipment air lock and the reactor passageway to the basement below the FCF air cell. The radiation shield is left in the basement and the sealed container is lifted through the floor hatch of the air cell into the air cell and from there into the argon cell of the FCF. Author (NSA)

N71-13606# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

EXPERIMENTAL RESULTS SECTION OF: STUDY OF INITIAL SINTERING MECHANICS

J. J. Bacmann et al Jul. 1970 25 p refs Transl. into ENGLISH from J. Nucl. Mater. (Amsterdam), no. 33, Dec. 1969 p 276–285 In ENGLISH and FRENCH
(LIB-Trans-267) Avail: AEC Depository Libraries

Sintering kinetics of UO2 compacts (using three different types of powder) were studied by recording their isothermal shrinkage under hydrogen between 700 and 1400 C in a high temperature dilatometer. A constant activation energy of 95 kcal/mole was found all over this temperature range, showing no influence of size and morphology of particles. This value is similar to the activation energy of uranium diffusion in UO2, which suggests that the sintering process in UO2 is not controlled by oxygen diffusion. When diffusion coefficients of uranium calculated from sintering data are compared to those deduced from radiotracer experiments, it is rather difficult to decide between a volume and/or a grain boundary diffusion mechanism. However, isothermal shrinkage curves can be more satisfactorily interpreted when a sintering theory based on grain boundary diffusion is considered. Author (NSA)

N71-13812# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d-Etudes Nucleaires.

PREPARATION OF SAMPLES BY MICRO-MACHINING

L. Hayet May 1970 37 p refs In FRENCH Presented at the 12th Meeting on Hot Lab., Cadarache, France
(CEA-CONF-1564; CONF-700523-2) Avail: AEC Depository Libraries

Studies of fission products, stoichiometry, and fuel cladding reactions in irradiated plutonium fuel elements require small quantity sampling and accurate machining. According to the nature of the examinations to be carried out, sampling involves either exact positioning, very high precision, or rapid preparation. Various tools used such as lathes, fast cutters, ultrasonic machining tools, microsampling devices for powders, and dental mechanic's milling tools are reviewed and different sampling methods are described. Most of the machines are adapted from standard types; only the mechanical microsampling equipment is a specific item. Author (NSA)

N71-13824# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.

CALCULATION OF BOLTED JOINTS OF LARGE DIMENSIONS

J. Kuchta 1970 93 p refs

(ZJE-61) Avail: AEC Depository Libraries

Design aspects of nuclear reactor vessel main flanges and the numerical solution of associated problems are examined. Design of such flanges must be usually treated as an individual case for each reactor because the operating requirements are complicated and, in certain respects, unique to each vessel. To facilitate the design, a general method of calculation of the flanged joint with studs is derived and shaped into a program for a digital computer. The aim is to quickly evaluate the different design projects from the viewpoint of strength and to find out the effect of structural changes or changes of operating conditions. As an example the calculation of one reactor vessel is presented. Author (NSA)

N71-13627# Bettis Atomic Power Lab., Pittsburgh, Pa.

NOTES ON NUCLEAR REACTOR KINETICS

J. B. Yasinsky Jul. 1970 144 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-TM-960) Avail: NTIS

A survey of the field of nuclear reactor kinetics is presented with emphasis on the problem of describing the neutron distribution in nonsteady-state reactors. Group-diffusion theory is used as a basic model to develop the general reactor kinetics equations. Specific topics include interpretation of the adjoint flux and its mathematical utility, space-independent kinetics, the point kinetics equations, perturbation theory, the inhour equation, interpretation of experiments, temperature feedback, and stability. Topics concerning space-dependent kinetics are approximation methods such as finite differences, adiabatic, nodal, modal and synthesis techniques; fission product poisoning and xenon spatial stability. Author (NSA)

N71-13628# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

ASSUMPTIONS FOR THE COMPARISON OF BENDING AND GRADIENT MAGNET PARAMETERS AND COST

Juergen von Schaewen Dec. 1969 20 p refs

(NP-18357) Avail: AEC Depository Libraries

An attempt to get formulas for the cost of accelerator magnet systems is described. Starting from the magnet aperture, the other magnet parameters are calculated. A cost breakdown of the AGS is transposed to this system. The results are tested with prices of the ISR. Author (NSA)

N71-13634# Aktiebolaget Atomenergi, Stockholm (Sweden).

HYDRODYNAMIC AND HEAT TRANSFER MEASUREMENTS ON A FULL-SCALE SIMULATED 36-ROD MARVIKEN FUEL ELEMENT WITH NON-UNIFORM RADIAL HEAT FLUX DISTRIBUTION

O. Nylund, K. M. Becker (Royal Inst. of Tech., Stockholm, Sweden), R. Eklund, O. Gelius, I. Haga et al Nov. 1969 158 p refs

(FRIGG-3; R4-494/RL-1154) Avail: NTIS

Summaries are given from the results obtained for the second 36-rod cluster having radially nonuniform heat flux distribution. Included are also the results of a few tests of existing calculation models against the measured data. The full scale loop test program for the boiling channels of the Marviken reactor included investigations of axial and radial void distribution, single- and two-phase pressure drop, natural circulation mass velocity, stability limits as well as detailed dynamic characteristics, and burnout in natural and forced circulation. The experiments started with full length uniformly heated 6-rod and 36-rod test sections followed by a 36-rod test section with a nonuniform radial heat flux distribution. Author (NSA)

N71-13635# Institutt for Atomenergi, Halden (Norway).

EARLY EXPERIENCE WITH THE AEROBALL SYSTEM

W. S. A. Black Feb. 1970 66 p refs

(HPR-120) Avail: AEC Depository Libraries

The aeroball system installed during the Jan.–Feb. 1969 shutdown is described and the experience from the commissioning and the first three months of use of the system is detailed. The performance of the aeroball system during this first period of use is found to be satisfactory, and the accuracy of the obtained axial form factor is steadily improving as various error sources are eliminated. Reasonable comparisons are obtained between form factor states from the later aeroball measurements and those derived from simultaneous measurements of the other types of neutron flux detectors mounted in PEI-306. Author (NSA)

N71-13638# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.

INSPECTION DEVICE FOR RW 330 COMPUTER NEAR CABRI REACTOR

David De Costa Vieira, Bernard Merite, and Robert Parocco Mar. 1970 10 p In FRENCH

(CEA-N-1274) Avail: AEC Depository Libraries

The device is intended for inspection of the reactor control program. Inspection is achieved by the control of program duration; time base is given by the interval between two mark pulses from the computer memory drum. The program duration to be controlled is recorded in the memory-drum revolution number. During a correct program cycle a reset pulse must appear before the end of the program. The inspection device detects nonoccurrence of this condition, then switches on a sounding alarm and a relay for external use. Author (NSA)

N71-13639# Commissariat a l'Energie Atomique, Paris (France).

SAFETY-CRITICALITY: RECOMMENDATIONS CONCERNING THE STORAGE OF FISSILE MATERIALS

Jun. 1970 37 p In FRENCH

Avail: AEC Depository Libraries

General instructions relating to design and use of storage locations for fissile materials are given. Some standards are proposed and examples are given for storage of enriched uranium or plutonium in the form of ingots, solutions, solid waste, or fuel elements. Author (NSA)

N71-13640# Atomic Energy of Canada, Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.

OPERATION OF THE WR-1 ORGANIC COOLED RESEARCH REACTOR

D. R. Tegart Aug. 1970 12 p refs Presented at the Conf. on Reactor Operating Experience, San Juan, Puerto Rico

(AECL-3523; CONF-691009-10) Avail: AEC Depository Libraries

The organic cooled, heavy-water moderated, Canadian research reactor WR-1 has operated during the past four years at coolant outlet temperatures up to 375 C and with an average availability of over 85%. Its operation is claimed to be more trouble free than that of a pressurized water system, due chiefly to the high temperature obtainable with low operating pressure in the primary system and the very low radiation fields encountered near the primary piping. Coolant chemical control, equipment performance, and fuel management are all discussed, as are some of the problems peculiar to the use of organics, such as fire hazards. The future prospects of the organic-cooled concept indicate overall efficiencies of between 37 and 39%. Author (NSA)

N71-13643*# International Atomic Energy Agency, Vienna (Austria).

THE DEVELOPMENT IN FRANCE OF COMPONENTS OF

SODIUM CIRCUITS FOR SODIUM-COOLED FAST REACTORS AND FUTURE PERSPECTIVES

R. Pontier (AEC, Cadaracne Nucl. Res. Center), E. Benoist (Elec. de France, Cadarache), J. P. Delisle (AEC, Cadarache Nucl. Res. Center), P. Marmonier (AEC Cadarache Nucl. Res. Center), J. P. Crette et al 27 Mar. 1970 26 p Presented at the IAEA Colloq. on the Develop. of the Technol. of Sodium-Cooled Fast Reactors, Monaco, 23–27 Mar. 1970

(CONF-700307-5; SM-130/30) Avail: NTIS

The implementation of the Rapsodie and Phenix projects has gone hand in hand with the development of components which were adapted first to an experimental reactor and subsequently to a prototype reactor. The Rapsodie components have proved themselves by enabling the reactor to operate with a sizable load factor. Those for the Phenix are either being tested now or will be tested next year. New studies have been undertaken with a view to improving the Phenix components, to adapting them for a large reactor and to lowering their cost. Details are presented of what is being done along these lines as far as the main components of sodium circuits are concerned. Author (NSA)

N71-13644# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

THE APPLICATION OF A COMPUTER IN THE CENTRALIZED TREATMENT OF MEASUREMENTS AND SIGNALS RECEIVED FROM THE OSIRIS EXPERIMENTAL REACTOR

Jean Corre and Jean Dupuy 1970 16 p In FRENCH Presented at the Symp. on Computing and Industrial Automation, Nice, France

(CEA-CONF-1569; CONF-700533-1) Avail: AEC Depository Libraries

The role of a digital computer in utilizing the various necessary information required for the running of the Osiris research reactor is described. The principal parameters treated are: nuclear measurements, thermodynamic measurements, radioprotection measurements and measurements arising from experiments, and signals. The function fulfilled by the computer and its characteristics, its mode of operation and its programming are described. Author (NSA)

N71-13645# European Atomic Energy Community, Karlsruhe (West Germany). European Transuranium Inst.

INSPECTION OF IRRADIATED MATERIALS BY MEANS OF A MICROPROBE AS ILLUSTRATED BY UO2–Mo AND UO2-ZIRCALOY NUCLEAR FUEL CERMETS

G. Giacchetti and J. Raensch 1970 56 p refs In GERMAN

(EUR-4504) Avail: AEC Depository Libraries

Knowledge of the chemicophysical behavior of the fuel elements and reactor components in the core is of crucial importance with regard to the functioning and useful life of a reactor. Although in principle all methods which were used, even for nonirradiated samples, such as physical inspection, gas analysis, X-ray spectrometry, alpha and beta autoradiography, and metallographic inspection, may be applied, microanalysis by the electron beam microprobe appeared to be particularly suitable as a means of obtaining information on the distribution of fission products in the fuel elements, diffusion processes or corrosion phenomena in cladding materials. Author (NSA)

N71-13677# General Electric Co., San Calif. Atomic Power Equipment Dept.

RESPONSE OF A SIMULATED BWR FUEL BUNDLE COOLED BY FLOODING UNDER LOSS-OF-COOLANT CONDITIONS

J. D. Duncan and J. E. Leonard Dec. 1969 36 p refs Prepared for Idaho Nuclear Corp.

(Contract AT(10-1)-1230)

(GEAP-10117) Avail: NTIS

The cooling effectiveness of bottom flooding a BWR fuel assembly during loss of normal coolant was investigated. Simulated loss of coolant transient tests were conducted with a full scale electrically heated bundle at atmospheric pressure. The temperature response of the bundle was obtained as a function of power level, initial temperature, and coolant flow rate. The results are consistent with those obtained by other investigators, and they demonstrate that this cooling method is effective as a standby cooling system to protect a reactor core in the unlikely event of a loss of coolant accident. Author (NSA)

N71-13678# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

PERFORMANCE OF MOLYBDENUM FILAMENTS IN BWR EMERGENCY COOLING HEAT TRANSFER TESTS

J. D. Duncan and R. G. Bock Nov. 1969 37 p refs Prepared for Idaho Nuclear Corp.

(Contract AT(10-1)-1230)

(GEAP-10092) Avail: NTIS

The performanc of molybdenum filaments as fuel rod simulator heating elements in BWR emergency cooling heat transfer tests has been evaluated. Analysis of test data and a simplified analytical model indicates that molybdenum's high temperature coefficient of electrical resistivity causes a nontypical spatial power distribution in test bundles. Molybdenum is therefore not suitable for use in emergency cooling heat transfer tests intended to demonstrate the thermal performance of BWR fuel rods during a loss of coolant accident temperature transient. The high temperature capability of molybdenum can be exploited in tests directed at the determination of Zircaloy cladding performance under high temperature emergency cooling conditions. The results of such tests can not be interpreted as being representative of the thermal performance of BWR fuel bundles undergoing loss of coolant accident/emergency cooling transients. Author (NSA)

N71-13679# Battelle-Northwest, Richland, Wash.

DESIGN FOR MATERIAL RADIATION DAMAGE IN THE FFTF

L. M. Finch Aug. 1970 20 p refs Presented at 17th Conf. on Remote Systems Technol., San Francisco, 30 Nov.–4 Dec. 1969

(Contract AT(45-1)-1830)

(BNWL-SA-2954; Conf-691102-26) Avail: NTIS

A design philosophy was evolved for Fast Test Reactor (FTR) to accommodate unknown structural material damage resulting from high fluence, fast neutron irradiation. Three damage categories of increasing stringency are proposed with concurrently stringent analytical requirements. Examples are cited of pertinent design problems arising from radiation damage to fast reactor structures. Author (NSA)

N71-13697# Comitato Nazionale per l'Energie Nucleare, Rome (Italy).

UNCONTROLLABLE PROMPT CRITICAL EXCURSIONS IN A FAST REACTOR COOLED BY SODIUM [ESCURSIONI PRONTO-CRITICHE INCONTROLLATE IN UN REATTORE VELOCE RAFFREDDATO A SODIO]

G. Dominici and R. Tavoni 2 Feb. 1970 37 p refs In ITALIAN

(RT/ING/70/2) Avail: AEC Depository Libraries

In order to define the Design Basis Accident for the PCC fast reactor, the amount of destructive energy that can be released at the end of a nuclear excursion due to the insertion of an infinite reactivity ramp has been calculated. A detailed analysis has allowed an evaluation of how the inserted ramp and the main

reactor characteristics can influence the transient under examination The study has been carried out under both the conditions of sodium initially inside the core and totally absent from the core. Author (NSA)

N71-13751# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
INVESTIGATION OF THE GROWING NON-HERMETICITY OF FUEL ELEMENT CANS BY MEANS OF KRYPTON-88
G. A. Kotelnikov, and V. F. Leonov 1969 12 p refs In RUSSIAN; ENGLISH summary
(IAE-1893) Avail: AEC Depository Libraries

The process of development of non-hermeticity of U–Al fuel element cans has been investigated in the water coolant flow with transfer time about 10 min. The gaseous fission product, Kr(88) has been used for the indication of non-hermeticity. The gamma radiation from Kr(88) has been recorded by the gamma-spectrometry method and also in the counting regime by means of an integral discriminator set to the energy above 1.6 MeV. During the transition process of increasing the reactor power up to the preset level the pulse outflow of Kr(88) was observed. The amplitude of pulses increased after after the reactor operated for a long time at the zeropower. In the stationary conditions the Kr(88) activity level varied only slightly. NSA

N71-13752# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
DETERMINATION OF THE OPERATING THERMAL CONDUCTIVITY OF CERAMIC FUEL AND THE COEFFICIENT OF THERMAL CONDUCTIVITY OF THE FISSION GAS BETWEEN THE FUEL AND TUBE ACCORDING TO THE BALANCED OSCILLATOR METHOD [BESTIMMUNG DER BETRIEBSMAESSIGEN WAERMELEITFAEHIGKEIT VON KERAMISCHEM KERNBRENNSTOFF UND DER WAERMEDURCHGANGSZAHL DES GASSPALTES ZWISCHEN BRENNSTOFF UND HUELLROHR NACH DEM BALANCED OSCILLATOR VERFAHREN]
W. Daenner Jan. 1970 171 p refs In GERMAN; ENGLISH summary
(KFK-1125) Avail: AEC Depository Libraries

A balanced oscillator method is described in respect of in pile application for measuring the thermal conductivity of ceramic fuels and the gap conductance. It is based upon a comparison of the experimentally and analytically determined transfer function between sinusoidal oscillations in coolant flow and specimen power at constant coolant temperatures. The analytical solution of the transfer function is deduced from the instationary differential equation for heat conduction, taking into consideration radial variation of heat source, heat capacity of the canning, and time dependence of heat transfer coefficient. The result of out pile experiments using coal as specimens prove the feasibility of such experiments and the completeness of the assumptions set up for the analytical solution. Some hints to the in pile realization of the method are included. Author (NSA)

N71-13763# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
CELL CALCULATIONS FOR REACTOR FUEL CONTAINING Gd AS A BURNABLE POISON
U. Caldognetto and F. Pistolla 29 Apr. 1970 53 p refs
(RT/FI-(70)21) Avail: AEC Depository Libraries

The cell constants are calculated for a set of reference reactor cells containing burnable poisons by simplified as well as sophisticated models. Calculations of flux distributions are performed to evaluate to what extent the deviations appearing among the results of the different models affect the power distribution. In addition it is shown that enough information is available on the absorption rate of Gd in the poisoned pins when the activation rates of few standard detectors are known. Author (NSA)

N71-13764# Los Alamos Scientific Lab., N.Mex.
SYNTHESIS METHODS AND VARIATIONAL METHODS IN NUCLEAR REACTOR THEORY, PHYSICS, AND COMPUTATIONAL METHODS: A BIBLIOGRAPHY
Jean Furnish, comp. Aug. 1970 48 p refs
(Contract W-7405-eng-36)
(LA-4461) Avail: NTIS

A search of Nuclear Science Abstracts, v. 16 (1962)-v. 23 (1969) was made for information on synthesis and variational methods in nuclear reactor theory and physics, and the computational methods involved. Abstracts are reproduced from Nuclear Science Abstracts with those from the most recent volume given first. Within each volume the arrangement is numerical. A rough delineation of subjects has been indicated as follows: neutron transport theory; static group diffusion theory; reactor kinetics; reactor burnup and fuel cycle analysis; reactor space-energy synthesis; reactors-general; reactor multidimensional space synthesis; and reactor shielding. Entries not so marked are for miscellaneous material. An index of personal authors appears at the end of the compilation. Author (NSA)

N71-13765# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
IRRADIATION DEVICES USED IN FRENCH RESEARCH REACTORS [LES DISPOSITIFS D'IRRADIATION DANS LES REACTEURS DE RECHERCHE FRANCAIS]
Bernard Lerouge [1970] 20 p In FRENCH Presented at the French Tech. Week Meeting, Belgrade, 22-30 Jun. 1970
(CEA-Conf-1570; Conf-700622-1) Avail: AEC Depository Libraries

Irradiation devices are principally used in research concerning the development of power reactors and their fuels. The associated technical problems are: corrosion, neutron absorption, induced heating effects and control. Specific problems concerning capsule and loop devices and the associated materials were considered. It was found necessary to use a very wide range of techniques. Author (NSA)

N71-13766# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
AN APPROACH TO COMPARE AIR POLLUTION OF FOSSIL AND NUCLEAR POWER PLANTS
P. Jansen, S. Jordan, and W. Schikarski 1969 18 p refs Presented at Symp. on Environ. Aspects of Nucl. Power Sta., New York, 10-14 Aug. 1970
(Conf-700810-20; SM-148/57) Avail: AEC Depository Libraries

The possible air pollution of fossil and nuclear power plants is discussed. Since the emissions of fossil and nuclear power plants are different in nature and effect on the environment, the comperison of the air pollution of power plants is difficult. This is mainly due to the fact that fossil power plants pollute air by the emission of reactive gases (i.e., sulphur oxides) and smoke (aerosols) whereas nuclear power plants could emit radioactive gases (i.e., fission gases) and radioactive aerosols which affect the environment in a different way. A study has been carried out to compare air pollution of both nuclear and fossil fuelled power plants. Two models have been used in the study. The first was developed on the basis of the maximum permissible concentrations set by biophysical and medical bodies for the various pollutants. The second model used the fact that excessive burdens by the various pollutants to the surrounding population lead statistically to a certain number of cases of illness or death. Author (NSA)

N71-13757# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DECONTAMINATION STUDIES FOR N REACTOR
J. A. Ayres 22 May 1970 31 p refs
(Contract AT(45-1)-1830)
(BNWL-CC-2659) Avail: NTIS

The radioactive films that are formed in pressurized water reactors, the resulting problems, and the procedures that may be used to remove these films and decontaminate the reactor are described. The discussion is centered principally on problems relating to decontamination of reactors containing carbon steel piping. The use of neutral chelating solutions for cleaning and maintaining cleanliness in a nuclear reactor is discussed in detail. Author (NSA)

N71-13759# Kernforschungszentrum, Karlsruhe (West Germany). Zyklotron Lab.
OPERATION OF THE KARLSRUHE ISOCHRONOUS CYCLOTRON IN 1969
G. Schatz and F. Schulz Jun. 1970 9 p refs
(NP-18358) Avail: AEC Depository Libraries

Causes of unscheduled shutdown, user statistics, radiation dose at the surface of different machine parts, and total radiation dose received by operating personnel are listed. NSA

N71-13760# Atomics International, Canoga Park, Calif.
AEROSOL MODELING OF HYPOTHETICAL LMFBR ACCIDENTS
R. L. Koontz, L. Baurmash, M. A. Greenfield, C. T. Nelson, D. F. Hausknecht et al 31 Aug. 1970 88 p refs
(Contract AT(04-2)-701)
(AI-AEC-12977) Avail: NTIS

A description of an aerosol model which is consistent with existing experimental data and which can be defended for use in design or licensing of LMFBR's is presented. Comparison of theory and experiments performed in a vessel whose height is typical of LMFBR inner containment are presented for four independent time varying parameters. A detailed justification of the model and the application of various model assumptions and parameters to accident conditions is described. A description is presented of additional aerosol behavior characteristics suggested by experimental data or analytical considerations, which are not completely resolved. The potential effects of these characteristics are evaluated by parameter sensitivity evaluation with the model. Author (NSA)

N71-13761# Idaho Nuclear Corp., Idaho Falls.
NUCLEAR SAFETY PROGRAM DIVISION Quarterly Technical Report, 1 Oct.–31 Dec. 1969
K. A. Dietz, ed. Aug. 1970 64 p refs
(Contract AT(10-1)-1230)
(IN-1320) Avail: NTIS

Research progress is reported on the effects of coolant loss conditions on pressure distribution in pressurized water power reactor containment structures, heat transfer in bundle type water-cooled fuel elements, the effects of partial core blockage on the performance of emergency core cooling systems for pressurized water power reactors, RAHDT computer program for radiative heat transfer in bundle type fuel element assemblies for boiling water reactors, and comparison of calculation methods for mass and energy distribution for coolant loss conditions in pressurized water power reactors. NSA

N71-13771# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
NEUTRONICS AND ASSOCIATED ASPECTS IN THE DESIGN OF SMALL BERYLLIUM OXIDE MODERATED HTGC REACTORS
G. E. Manning Mar. 1970 42 p refs
(AAEC/TM-534) Avail: AEC Depository Libraries

The results of detailed neutronic design calculations are presented and discussed for a specific ordered array design of a small pebble-bed beryllium oxide moderated air cooled reactor which represents a simple and feasible power reactor demonstration concept. Some survey calculations relating to slightly larger-sized continuously refueled pebble bed reactors are also provided. The concepts are compared and means of significantly improving performance are suggested. The work described forms part of the ABORIGINE (Air cooled-Beryllium-Oxide-Reactor-with-Integral-Gas-turbine) Project. Author (NSA)

N71-13795# Academia R. P. R., Bucharest. Institutul De Fizica Atomica.
NEW RESULTS IN VITROCERAMIC NUCLEAR FUEL RESEARCH
I. Alecu, I. Beleuta, and M. Ciocanescu 1970 23 p refs
(IFA-MN-11) Avail: AEC Depository Libraries

A technique to produce UO_2-SiO_2 vitroceramic fuels by melting, was developed. This material is suitable as a base of manufacturing a honeycomb-type, coated fuel element. An equilibrium diagram for $UO-SiO_2$ is given. By studying the chemical compatibility of the vitroceramic fuel with a series of gases, it was established that a mixture of 95% CO_2 and 5% CO, compatible with the fuel up to 900 C, may be used as coolant. This led to the choice of an aluminum silicate coating with a high Zr compound content. Radiation effects on the material were studied. The irradiation-induced defects modifying the conductivity are oxygen vacancies. Data are given in graphs on radiation effects on electric conductivity, dimensional changes, and thermal diffusivity. NSA

N71-13796# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
CONSIDERATIONS ABOUT SYNTHESIS AND SINTERING OF NUCLEAR CERAMIC FUELS (UO_2 AND UC)
I. Mirion, A. Gutu, S. Demetrescu, and I. Jitea 1970 9 p refs
(IFA-MN-10) Avail: AEC Depository Libraries

Research was centered on the synthesis and sintering of nuclear ceramic fuels at a temperature as low as possible. The investigations led to a method for uranium dioxide powder preparation, pressing, and sintering by which a 10.4 g/sq cm minimal density for samples is usually achieved. The sintering temperature is maintained at 1350 C for 4.5 hours. The uranium carbide snythesis was achieved through a carboreduction of uranium salts at temperatures starting from 1400 C in hydrogen atmosphere. Uranium monocarbide was obtained at a ratio of 93% after a hydrogen retreatment at 1450 C. The density of the reacted pellets ranged from 10.7 to 11.4 g/sq cm. Author (NSA)

N71-13797# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE BURST SLUG DETECTION METHODS [ETUDE COMPARATIVE DES METHODES DE DRG-G]
Zdenek Melichar Jun. 1970 64 p refs In FRENCH
(CEA-N-1356) Avail: AEC Depository Libraries

The detection of a burst slug in a power reactor must occur in the least possible time. A study was made of the various methods of surveillance of the Saint Laurent 1 reactor: mechanical filtration, electrostatic collection (continuous and delayed), and total gamma radiation measurements. Only the first two methods, which are essentially similar to delayed neutrons measurements, lead to sufficiently short response times. Author (NSA)

N71-13814# Institute of Technology, Helsinki (Finland). Dept. of Technical Physics.
RESONANCE INTEGRAL OF NATURAL ZIRCONIUM

Jaakko Saastamoinen 1970 6 p refs
(TKK-F-A-106) Avail: AEC Depository Libraries

The resonance integral of natural Zr was calculated for Zr rods of varying diameter and for the Triga fuel elements using different resonance parameters. The results are compared with values from other calculations and from experiments. Author (NSA)

N71-13817# Commissariat a l'Energie Atomique, Brussels (Belgium). Centre d'Etude de l'Energie Nucleaire.
CHEMICAL DECLADDING OF NONIRRADIATED, STAINLESS-STEEL CANNED URANIUM DIOXIDE FUEL ELEMENTS
G. Dumont and W. Goossens Jan. 1969 41 p refs
(Contracts EURATOM-006-65-7-RCIB(B); EURATOM-016-65-1-RAP-B)
(BLG-435) Avail: AEC Depository Libraries

In reprocessing nuclear fuel it is necessary to remove the clad prior to treating the fuel itself adequately. For stainless steel-clad fuel, gaseous mixtures of hydrogen fluoride and oxygen at temperatures above 550 C can be used. Data obtained for non-irradiated AISI 304 L stainless steel-clad uranium dioxide pellets are described. Experiments were performed in a boat reactor and in chemical columns up to 10 cm in diameter for assemblies up to 19 elements 50 cm long. These studies revealed the main factors for scale-up such as the geometry of the bundle, the absence or presence of fluidized alumina, the prefluorination of the correct type of alumina, and the influence of the self-regulative character of the reaction. Author (NSA)

N71-13952# Argonne National Lab., Ill.
HARTREE-FOCK WAVE FUNCTIONS AND COMPUTED ONE-ELECTRON PROPERTIES FOR OXYGEN MONOFLUORIDE (OF, 2-PION) AT SIX INTERNUCLEAR SEPARATIONS
P. A. G. O'Hare and Arnold C. Wahl Jun. 1970 12 p refs
(Contract W-31-109-eng-38)
(ANL-7702) Avail: NTIS

The Roothaan expansion method was used to compute self-consistent-field wave functions close to the Hartree-Fock limit for oxygen monofluoride at six internuclear separations. A Dunham analysis yielded 2.4958 bohrs for the equilibrium bond length; the corresponding energy was −174.19502 Hartrees. The detailed wave functions are given together with the corresponding computed energies and one-electron properties. At equilibrium bond length, the dipole moment is found to be 0.36 D with the negative end of the dipole at the fluorine atom. Author

N71-13954# Idaho Nuclear Corp., Idaho Falls.
RELAP3: A COMPUTER PROGRAM FOR REACTOR BLOWDOWN ANALYSIS
W. H. Rettig, G. A. Jayne, K. V. Moore, C. E. Salter, and M. L. Uptmor Jun. 1970 123 p refs
(Contract AT(10-1)-1230)
(IN-1321) Avail: NTIS

RELAP3 is a computer program, written in FORTRAN 4, that describes the behavior of water-cooled nuclear reactors during postulated accidents such as loss-of-coolant, pump failure, or power transients. The behavior of the primary cooling system and the reactor is emphasized. The program calculates flows, mass inventories, energy inventories, pressures, temperatures, and qualities along with variables associated with reactor power, reactor heat transfer, or control systems. The program is sufficiently versatile to describe simple hydraulic systems as well as complex reactor systems. The user must define the geometric description of the system to be analyzed as well as an appropriate set of initial conditions. RELAP3 then solves an integral form of the fluid conservation and state equations applied to each user-defined control volume. Currently, the number of these volumes is limited to 20 and the number of junctions (flow paths) between volumes to 50. Author (NSA)

N71-13955# Battelle-Northwest, Richland, Wash.
FFTF CLOSED LOOP TEST CHARACTERISTICS
R. E. Keyes Jun. 1970 58 p refs
(Contract AT(45-1)-1830)
(BNWL-1251) Avail: NTIS

A set of curves which characterize the FFTF closed loop testing capability are presented. Limiting parameters for candidate breeder-reactor fuels are discussed. Heat removal requirements of the ex-reactor loop system are set by the maximum of a variety of possible test designs. The study concludes that a 2 MW heat removal capacity is adequate for a maximum test diameter of 2.5 in. Author (NSA)

N71-13956# Battelle Memorial Inst., Columbus, Ohio.
AN EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR-REACTOR ACCIDENT Quarterly Progress Report, Apr.–Jun. 1970
Wayne A. Carbiener and Robert L. Ritzman Jul. 1970 52 p refs
(Contract W-7405-eng-92)
(BMI-1885) Avail: NTIS

Analytical description of the consequences of a nuclear reactor accident is proposed in an effort to estimate the degree of safety embodied in the design and construction of nuclear power plants. This study is restricted to pressurized-water and boiling-water reactors and postulates a loss of coolant situation. Under the reactor accident evaluation subtask, studies of thermal and hydraulic processes are being conducted. Summary of significant results includes the following: (1) prompt fission product release (2) iodine removal by containment sprays (3) fate of fission products in pressure suppression pools (4) reactor kinetics (5) design basis accident heat transfer, and (6) loss of cooling accidents. E.M.C.

N71-13962# Bettis Atomic Power Lab., Pittsburgh, Pa.
ASSESSMENT OF SAFETY INJECTION STRATEGIES DURING LOSS OF COOLANT ACCIDENTS
D. C. Bauer Nov. 1969 131 p ref Presented at 17th Conf. on Remote Systems Tech., San Francisco
(Contract AT(11-1)-Gen-14)
(WAPD-T-2222; CONF-691102-25) Avail: NTIS

The results of 20 PWR low pressure blowdown tests are summarized. The specific purpose of the PWR testing was to assess the effect of different spray patterns and injection locations on channel flow and test plate cooling. The major observations emerging from the tests were: (1) Injection above the test sections in the upper plenum encourages upward flow steam and percolation cooling of the plates. (2) The effectiveness of above core injection depends upon its dispersion at different times during the transient. (3) The effectiveness of below core injection depends upon its volume delivery rate and arrival time at the bottom of the channels, not its dispersion. (4) For seed test section heat fluxes of approximately 8000 Btu/hr-sq ft bottom or top injection alone was insufficient to cool the test sections for any injection rates up to 2 gpm. (Water stacked up above the plates.) (5) Successfully cooled tests were characterized by upward flow of a steam-water mixture and the absence of channel superheat. Author (NSA)

N71-13963# Gulf General Atomic, San Diego, Calif.
POSTIRRADIATION EXAMINATION OF PEACH BOTTOM REFLECTOR ELEMENT B10-01 AFTER EXPOSURE TO 300 EFFECTIVE FULL POWER DAYS
H. R. W. Cobb 1 Feb. 1970 34 p refs

(Contract AT(04-3)-314)
(GAMD-9911) Avail: NTIS

The results of hot cell examination of a graphite side-reflector element after 300 effective full power days (EFPD) in a high-flux and high-temperature position in the Peach Bottom reactor are reported. No significant distortion was detected in this examination, which indicated that similarly positioned reflector elements at Peach Bottom could be used to fast fluences well beyond their intended life of 1350 EFPD. The reasons for the limited amount of axial distortion as well as the causes of the discrete areas of carbonaceous deposit observed on the surfaces of the element are discussed. Author (NSA)

N71-13965# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EXPERIMENTAL HIGH ENTHALPY WATER BLOWDOWN FROM A SIMPLE VESSEL THROUGH A BOTTOM OUTLET
R. T. Allemann, A. J. McElfresh, A. S. Neuls, W. C. Townsend, N. P. Wilburn et al Jun. 1970 244 p refs
(Contract AT(45-1)-1830)
(BNWL-1411) Avail: NTIS

Safety studies simulating pressurized water and boiling water reactor hypothetical piping breaks were conducted in a 150 cu ft vessel. High pressure water blowdowns (up to 2100 psi, 600 F) were studied with orifice diameters of 1.5 to 6.8 in. from a bottom nozzle. Internal pressure and temperature, liquid level, thrust reaction forces, weight of fluid in the vessel, void fraction of the fluid in the exit duct were measured during the blowdowns. Void fraction increased and mass velocity decreased with orifice size. Anomalous subcooled pressure behavior was thought to be caused by nitrogen dissolved in the water. Liquid level decreased nonlinearly with time, whereas mass loss rate was nearly constant for most of the blowdown. Comparisons with theoretical treatments showed the need for empirical coefficients to adjust predictions to the observed results. Author (NSA)

N71-13966# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CERAMIC FUELS FOR HEAVY WATER REACTORS
R. J. Anicetti, ed. Jun. 1970 81 p refs
(Contract AT(45-1)-1830)
(BNWL-1435) Avail: NTIS

Ceramic oxide fuels have achieved a commanding lead for water cooled reactor fuels. Fuel fabrication technology, fuel irradiation behavior, and limitations for these materials are summarized. Information presented covers work since 1964. Most oxide fuel fabrication and irradiation experiences are valid for all water reactor fuels, including heavy water reactors unless otherwise specified. Author (NSA)

N71-13967# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FFTF FUEL PIN AND SUBASSEMBLY CONCEPTUAL DESIGN METHODS AND DATA
E. G. Stevens, P. D. Cohn, R. J. Jackson, D. C. Kolesar, C. L. Mohr et al Jun. 1970 186 p refs
(Contract AT(45-1)-1830)
(BNWL-1064) Avail: NTIS

The major technical bases for the FFTF first core fuel assembly conceptual design are presented in four general categories: thermal; hydraulic; structural; and performance and manufacturing design characteristics. Recommended design values and conceptual engineering drawings of the fuel pin and subassembly are included. Author (NSA)

N71-13968# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, Nov. 1969–Jan. 1970
Feb. 1970 128 p refs
(Contract AT(04-3)-189)
(GEAP-10028-33) Avail: NTIS

Continuing research activities in the development of fast reactors employing ceramic fuels are described. The areas of investigation include defected fuel behavior, safety experiments, fuel properties and performance, core design and physics, fuel element design, cladding development, fast flux tests, and kinetics analysis. N.E.N.

N71-13969# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THERMAL AND HYDRAULIC ANALYSIS OF A PHOENIX FUEL IN THE MATERIALS TEST REACTOR
R. M. Hiatt Jun. 1970 93 p refs
(Contract AT(45-1)-1830)
(BNWL-1409) Avail: NTIS

A Phoenix fuel loading of the materials test reactor at Idaho was investigated to determine safe operating power levels based on thermal and hydraulic considerations. Design points are clearly stated with emphasis placed on flow problems and heat transfer burnout limits. Author (NSA)

N71-13970# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
DESIGN AND ANALYSIS OF SEFOR CORE 1
R. A. Meyer, A. B. Reynolds, S. L. Stewart, M. L. Johnson, and E. R. Craig Jun. 1970 286 p refs
(Contract AT(04-3)-540)
(GEAP-13598) Avail: NTIS

The thermal-hydraulic, mechanical and neutronic analysis and design of SEFOR Core I is described. Both the static and transient aspects of the reactor operation are considered in the analysis of fuel rod and core structure behavior. Design details of the fuel rod and core hardware are presented together with a mechanical design evaluation. Author (NSA)

N71-13971# Oak Ridge National Lab., Tenn.
COMPUTER HANDLING OF REACTOR DATA FOR SAFETY: CHORD-S
T. E. Cole and F. A. Heddleson Aug. 1970 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2928) Avail: NTIS

Investigated was the feasibility of computerizing reactor design data so that rapid, versatile retrieval of desired information was possible. In data handling and communications networks, it seemed appropriate to make a complete review of the two years of development effort. Post-project evaluation, description, accomplishments, and a complete bibliography for the project are presented. The project proved the feasibility of computerizing reactor design data. An operational system was developed and is being used to obtain general information on about 70 reactors. Author (NSA)

N71-13972# Battelle Memorial Inst., Columbus, Ohio.
ADEP-1 AND ADEF-2: ONE- AND TWO-DIMENSIONAL FEW-GROUP KINETIC CODES
Richard S. Denning Aug. 1970 15 p refs
(Contract W-7405-eng-92)
(BMI-1888) Avail: NTIS

The ADEP-1 and ADEP-2 codes, developed for use in the reactor safety program, solve the few-group, neutron-diffusion equations in time and one or two spatial dimensions, respectively. The present version of each code is restricted to Cartesian coordinates and two energy groups. Lumped parameter thermal-hydraulic equations are used for the calculation of feedback. Two types of alternating-direction, explicit integration schemes are permitted at the option of the user. Author (NSA)

N71-13973# General Electric Co., San Jose, Calif. Reactor Fuels and Reprocessing Dept.
ZIRCALOY-CLAD UO2 FUEL ROD EVALUATION PROGRAM Quarterly Progress Report, Nov. 1969–Jan. 1970
F. H. Mergeth, comp. Feb. 1970 22 p refs
(Contract AT(04-3)-189)
(GEAP-10160; QPR-9) Avail: NTIS

The content of americium isotopes, curium isotopes, and neptunium isotopes in high burnup uranium oxide fuels was determined and the performance of Zircaloy clad uranium oxide evaluated. Complete isotopic composition of high burnup uranium oxide and transverse tensile properties of irradiated rings were also considered. NSA

N71-13974# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM Quarterly Report, Feb.–Apr. 1970
G. R. Pflasterer and R. A. Becker, comps. May 1970 70 p refs
(Contract AT(04-3)-540)
(GEAP-10010-24; QR-24) Avail: NTIS

Work for the fast oxide reactor constituted fabrication of instrumented fuel assemblies, startup testing of plutonium oxide-uranium oxide fuel, reactivity worth determinations for reflectors and core materials, and maintenance operations. NSA

N71-13975# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION RESEARCH HIGHLIGHTS, JANUARY–DECEMBER 1969
Dec. 1969 79 p refs
(Contract W-31-109-eng-38)
(ANL-7650) Avail: NTIS

Progress is reported under the following headings: (1) fuel-cycle technology; (2) sodium technology; (3) materials chemistry and thermodynamics; (4) analytical and reactor chemistry; (5) chemistry of liquid metals and molten salts; and (6) fluidized-bed combustion of fossil fuels. A separate abstract was prepared for each of the 6 sections. NSA

N71-13984# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
FAST BREEDER REACTOR ADVANCED FUEL ELEMENT CLADDING FABRICATION Termination Report, 1 Jul.–31 Aug. 1969
R. G. Frank and C. O. Tarr Aug. 1970 48 p refs
(Contract AT(40-1)-2847)
(GEMP-745) Avail: NTIS

Commercially available cold worked and stress relieved molybdenum was found to have low tensile ductility (approximately 3%) over the expected service temperature range of the LMFBR, 550 to 750 C. This is in contrast to 35 to 45% elongation for recrystallized molybdenum. Thermal-mechanical processing studies were conducted to identify a processing sequence that would result in an optimum combination of strength and ductility in the temperature range of 550 to 750 C. It was found that a well worked structure in combination with a high stress relief temperature (955 C) results in tensile elongation in excess of 10% at 650 C. Author (NSA)

N71-13995# Linde Co., Tonawanda, N.Y.
THE DESIGN, DEVELOPMENT AND DELIVERY OF HIGH TEMPERATURE VACUUM INSULATION SYSTEMS FOR SNAP-21 THERMOELECTRIC POWER SYSTEM Appendix to Final Report
L. R. Niendorf [1970] 114 p Prepared for Minn. Mining and Mfg. Co., St. Paul
(Contract AT(30-1)-3691-5511)
(TID-25482-APP.) Avail: NTIS

Sections are included on getter requirements, calculations for proof testing, insulation materials, equations for temperature distribution in rods having one dimensional heat conduction, neck tube temperature profiles, load sharing equations, support system spring constants, prototype performance, heat loss calculations, acceptance test plans, and drawing identification. NSA

N71-14000# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EXPERIMENT DESCRIPTION FOR PNL MIXED OXIDES (UO2-PuO2) IRRADIATIONS IN THE GENERAL ELECTRIC TEST REACTOR
T. B. Burley and J. E. Hanson Jun. 1970 70 p refs
(Contract AT(45-1)-1830)
(BNWL-1382) Avail: NTIS

A fuel irradiation test program and capsule design are described for the evaluation of the steady state and transient performance characteristics of prototypic FTR length fuel pins. The fuel pins to be tested comprise 31 in. of mixed oxide (75% UO2–25% PuO2) fuel pellets clad in 0.250 in. diameter Type 304 stainless steel. The fuel pellets are 93% of theoretical density (TD) and with a 0.006 in. diametrical gap the fuel has an 88% TD smeared density. The capsule is a NaK bonded instrumented assembly designed to produce a fuel pin cladding surface temperature of 900 F and fuel central temperature of 4000 F when the fuel pin is producing 14.5 kW/ft (axial peak). The safety analysis, heat transfer calculations and operating instructions are also described. Author (NSA)

N71-14001# Argonne National Lab., Ill.
NUCLEAR DATA FOR THERMONUCLEAR REACTORS [YADERNYE DANNYE DLYA TERMOYADERNYKH REAKTOROV]
Yu. F. Chemilin et al 1970 38 p refs Transl. into ENGLISH from 2d Intern. Conf. on Nucl. Data for Reactors, IAEA (Helsinki), 15–19 Jun. 1970 24 p; Russian Paper No. CN-26/104 Sponsored by AEC
(ANL-Trans-842; CONF-700606-4; CN-26/104) Avail: NTIS

On the basis of an examination of the fundamental plan for a thermonuclear reactor, the problem of the nuclear data necessary for its creation is discussed. An analysis is presented of the nuclear data published through 1969 for the three basic materials that have been proposed for use in a thermonuclear reactor: Li-6, Li-7, and Nb. The requirements for nuclear data for these reactors are examined in the concluding part of the report. Author (NSA)

N71-14003# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
FUEL ROD DESIGN LIMIT AND TRANSIENT SURVIVAL CRITERIA
M. D. Carelli Jul. 1970 164 p refs
(Contract AT(30-1)-4138)
(WARD-4138-8) Avail: NTIS

The design limit and transient survival criteria for typical fuel elements of large Liquid Metal Fast Breeder Reactors (LMFBR) currently developed were quantitatively examined. An extensive review of the limiting conditions (essentially maximum allowable cladding and fuel temperatures, and tolerable amount of molten fuel) was carried out; the review indicates that such conditions are rather conservative with respect to the expected failure limits. The operational and off-normal transients which have a credible probability of occurring were thoroughly examined, their expected frequency during the fuel element lifetime evaluated, and their effect on the fuel and cladding temperature assessed. The maximum allowable amount of molten fuel during transients of the reactivity insertion type was determined, as well as the limiting cladding temperature during flow-reduction transients. The fatigue effect of repeated transients of the same kind was evaluated.
Author (NSA)

N71-14011# Idaho Nuclear Corp., Idaho Falls.
A CORRELATION OF ROD BUNDLE CRITICAL HEAT FLUX FOR WATER IN THE PRESSURE RANGE 150 TO 725 PSIA
E. Daniel Hughes Jul. 1970 22 p refs
(Contract AT(10-1)-1230)
(IN-1412) Avail: NTIS

Rod bundle critical heat flux data for water in the pressure range 150 to 725 psia were compiled and several correlations derived. The analysis was conducted only for steady state data obtained from uniform axial flux profile rods with stable upflow of the coolant. The selected correlation, that is, the best fit of the data, was compared with data outside of the range of parameters on which it was based and no definite error trends were noted. An analysis of the methods of correlation in current use is presented and the most accurate correlations are shown to be those that incorporate observed experimental results into the formulation of the correlation.
Author (NSA)

N71-14012# Oak Ridge National Lab., Tenn.
STUDIES IN APPLIED SOLID MECHANICS Progress Report
Aug. 1970 78 p refs
(Contract W-7405-eng-26)
(ORNL-4576) Avail: NTIS

The accomplishments made during 1969 on programs for developing structural design technology for piping components and for nozzle-to-pressure vessel attachment regions are described. These programs have as their primary objective the development of improved design methods for assuring, on a practical level, the structural integrity of the pressure vessels and primary coolant systems of nuclear power plants. The piping and nozzle programs are directed at obtaining experimentally proven methods of design and analysis. This information is used in the development of design rules and analytical procedures for incorporation into current industry-developed standards and USAEC supplemental standards. The technology is also applicable to nonnuclear systems.
Author (NSA)

N71-14013# Oak Ridge National Lab., Tenn.
RESULTS FROM IRRADIATION TESTING OF UO2 FUEL PINS DESIGNED FOR THE MEDIUM POWER REACTOR EXPERIMENT
S. C. Weaver, R. B. Fitts, K. R. Thoms, V. A. DeCarlo, R. L. Senn et al Aug. 1970 69 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2859) Avail: NTIS

Four UO2 fuel pins clad with stainless steel were tested in the Oak Ridge research reactor at linear heat ratings of 4.3 to 4.9 kw/ft, a cladding temperature of 830 C, and a fuel-center temperature of about 1400 C. Two of these fuel pins were prototypes for the Medium Power Reactor Experiment, while the other two contained extensometers to measure the change in the length of the fuel column as a function of time and burnup. One prototype pin and one pin with an extensometer operated for 17,000 hr to a burnup of 1.20 at. % U. All four pins operated without failure and all increases in pin diameter were less than 0.2%. The maximum fission gas released was an unexpected high of 13.1% after 17,000 hr. A potentially serious ratchetting problem occurred in the 17,000-hr extensometer test. The fuel column length shrank 0.048 in. during the first 3800 hr, increased 0.010 in. during the next 10,000 hr, and then began to increase very rapidly; during the last 3200 hr, the length increased 0.138 in. When the fuel column reached this length, the extensometer went off scale, and the capsule was removed from the reactor. Postirradiation examination revealed that part of the top pellet had separated from the rest of the fuel column and moved up the cladding.
Author (NSA)

N71-14015# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
AEROSOL TRANSPORT IN A CONDENSING-STEAM BOUNDARY LAYER
J. M. Hales, T. W. Horst, and L. C. Schwendiman 1 Jun. 1970 63 p refs
(Contract AT(45-1)-1830)
(BNWL-1125) Avail: NTIS

Results of a theoretical investigation of aerosol transport in a laminar, naturally convected, condensing-steam boundary layer are reported. Boundary-layer equations were extended to account for aerosol transport and solved for various cases of interest using a hybrid-computer technique. Effects of diffusiophoresis, thermophoresis, and Brownian motion are included in the aerosol transport analysis. Solutions are presented as profiles of temperature, velocity, steam concentration, and aerosol concentration. These are employed to obtain corresponding heat-transfer, aerosol-deposition, and condensation rates. For very small particle sizes, aerosol-deposition rates were found to decrease with increasing particle size. For larger sizes, deposition rates were found to be independent of particle size, and subject only to conditions within the air-steam boundary layer. The computed results are discussed primarily in the context of nuclear reactor containment-vessel analysis, where the deposition of aerosols in condensing steam environments is of particular interest.
Author (NSA)

N71-14016# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REACTOR PHYSICS QUARTERLY REPORT, APRIL–JUNE 1970
Aug. 1970 98 p refs
(Contract AT(45-1)-1830)
(BNWL-1381-2) Avail: NTIS

Research progress is reported on calculations of power distributions and reactivities in thermal reactors, nonlinear least-squares data analyses, critical experiments in UO2 4 wt % PuO2 fueled assemblies cooled with water, burnup data from the PRTR batch core experiment, Pu-H2O lattice subcritical experiments, HTLTR temperature coefficient and reactor pressure control, calculations of HTLTR safety rod temperature distributions, and PCTR measurement of k' sub infinity.
NSA

N71-14017# Atomics International, Canoga Park, Calif.
LMFBR SAFETY PROGRAMS, ANNUAL TECHNICAL PROGRESS REPORT, GFY 1970
15 Aug. 1970 79 p refs
(Contract AT(04-3)-701)
(AI-AEC-12970) Avail: NTIS

Research progress is reported on efforts to develop experimental information and analytical methods which characterize

the release and transport of effluents and energy generated during postulated major Liquid Metal Fast Breeder Reactor sodium accidents. The information to be developed is required for the design and safeguards analysis of economical sodium-cooled fast reactors. The results and technology obtained are also to be applied to the safety-analysis and engineering safeguards design for the Fast Flux Test Facility. NSA

N71-14018# Idaho Nuclear Corp., Idaho Falls.
LOFT CORE LENGTH STUDY
J. C. Haire and G. F. Brockett Aug. 1970 61 p refs
(Contract AT(10-1)-1230)
(IN-1391) Avail: NTIS

A scoping study was performed to determine the nuclear core length and other selected parameters that are required for the loss-of-fluid test (LOFT) system to have a thermal response during a loss-of-coolant accident (LOCA) similar to that of a large pressurized water reactor (PWR). This study was used as the basis for a recommendation regarding a minimum core length that would yield a thermal response similar to that of a large PWR. The general criterion for a similar thermal response is that the fuel cladding hot-spot temperature history during the time preceding the injection of emergency core coolant into the core approximate that of a large PWR. The RELAP 3 computer code was used to determine the pressure, coolant enthalpy, and mass flow rate existing at the entrance to the LOFT core during a transient. These quantities were then input into the THETA 1 code that was used to determine the fuel cladding temperature history. The effects of various primary system parameters, initial operating conditions, and calculational methods on the predicted core thermal response of LOFT were also determined. Author (NSA)

N71-14026# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
PLUTONIUM LATTICE EXPERIMENT IN UNIFORM TEST LATTICE OF UO2-1.5 PERCENT PuO2 FUEL
G. T. Fairburn, W. G. Pettus, and N. L. Snidow Aug. 1970 38 p refs
(Contract AT(45-1)-1830)
(BAW-1357) Avail: NTIS

The plutonium lattice experiments are conducted to provide data for verification of the analytical methods and models developed for the design of water-moderated plutonium recycle cores. Because of the great expense of performing conventional critical experiments with a variety of fuels, the program is restricted to small lattice experiments (SLE), which are essentially PCTR measurements that require a relatively small region of the test fuel surrounded by buffer and driver regions of conventional fuel. The system is tailored to provide a critical assembly with a small central test region having a nearly flat flux and asymptotic spectrum. The test region is incrementally poisoned with boric acid until a void substitution yields a null reactivity change. This gives a precise measure of the boron concentration required to reduce to unity the infinite medium multiplication factor of the test lattice. Comparison of this number with the corresponding analytical prediction is a sensitive and direct check on the adequacy of the theoretical procedures. Author (NSA)

N71-14027# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PROPOSAL TO IRRADIATE UNENCAPSULATED PINS IN THE EBR-2 SUBASSEMBLIES PNL-6, PNL-7, AND PNL-8
E. O. Ballard and L. A. Pember Jun. 1970 257 p refs
(Contract AT(45-1)-1830)
(BNWL-1103) Avail: NTIS

Three unencapsulated, 37-pin subassemblies will be irradiated in the EBR-2 in support of the FFTF Driver Fuel Development Program. The fuel pin parameters will be typical of proposed FFTF fuel pin designs. The pins will be irradiated under conditions approximating as nearly as possible those proposed for the FFTF. These pins will operate at linear heat ratings between 6 and 15 kW/ft to exposures of 80,000 MWd/MTM. The fuel will be solid pellets with a nominal fuel smeared density of 88% TD. The primary objective is to obtain statistically significant data on swelling behavior, gas release rates, and general irradiation performance of pins fabricated with typical FTR fuel pin parameters and tolerances and irradiated under approximately FTR conditions. Author (NSA)

N71-14028# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PROPOSAL TO IRRADIATE UNENCAPSULATED INSTRUMENTED FUEL PINS IN THE EBR-2 SUBASSEMBLY PNL-17
E. O. Ballard and M. K. Millhollen Jun. 1970 256 p refs
(Contract AT(45-1)-1830)
(BNWL-1420) Avail: NTIS

A 37-pin, instrumented subassembly will be irradiated in the EBR-II in support of the FFTF Driver Fuel Development Program. The pins will be unencapsulated and parameters will be typical of proposed FFTF fuel pin designs. The pins will be irradiated under conditions approximating as nearly as possible those proposed for the FFTF. They will operate at a maximum linear heat rating of approximately 12 kW/ft (82.5 MW reactor power) to an exposure of approximately 10 – 20,000 MWd/MTM. The fuel will consist of pressed and sintered $UO_2 - PuO_2$ cylindrical pellets with a theoretical density of 93 + or – 2%. The principal purpose of this test is to determine the coolant flow-heat balance characteristics of a 37-pin subassembly in a manner to allow confirmation of calculational methods applied to other irradiation test assemblies. A secondary purpose of the test is to determine the validity of the use of silicon carbide as a temperature monitor within fuel pins. Author (NSA)

N71-14037*# AiResearch Mfg. Co., Los Angeles, Calif.
CONCEPTUAL DESIGN STUDY OF NUCLEAR BRAYTON CYCLE HEAT EXCHANGER AND DUCT ASSEMBLY (HXDA), PHASE 1
M. G. Coombs, C. J. Morse, and C. E. Richard 4 Dec. 1970 346 p
(Contract NAS3-13453)
(NASA-CR-72783; AiResearch-70-6691) Avail: NTIS CSCL 18E

Parametric data of heat exchanger size and weight for nuclear reactor Brayton cycle space power systems in the 150 kWe range are presented. Optimized designs of heat exchanger and duct assemblies are developed over a wide range of Brayton cycle operating conditions with particular emphasis on those associated with the SNAP-8 reactor capabilities. Author

N71-14047# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Report, Jan. – Mar. 1970
Apr. 1970 64 p refs
(Contract AT(04-3)-189)
(GEAP-11089; QR-20) Avail: NTIS

The objective of this program is to improve the reliability of reactor system piping by increasing current knowledge of failure causing mechanisms, and by enhancing capability for design evaluation and analysis. Toward the attainment of this objective, work was continued on the following tasks: (1) estimating the probability of leakage due to low-cycle fatigue at a selected pipe section (2) evaluating finite element codes in connection with stress analysis studies (3) fracture mechanics of elbows and tees

using hydrostatic pressure (4) low-cycle fatigue tests on cold carbon steel tee using out-of-plane and in-plane loading through the branch; and determining quantitatively the effect of BWR primary coolant on the low-cycle fatigue life of piping steels. E.M.C.

N71-14077*# Aerojet-General Corp., Sacramento, Calif. Nuclear Div.

PREVENTION OF RUST IN THE ID WELD AND HEAT AFFECTED ZONE OF CRES 347 NERVA LINES. NERVA PROGRAM

C. W. Fletcher Aug. 1969 21 p
(Contract SNP-1)
(NASA-CR-111730; RN-S-516) Avail: NTIS CSCL 18E

NERVA stainless steel lines that transport fluids must satisfy rigid levels of cleanliness. One of the most persistent causes of contamination has been the formation of rust in the welds and heat affected zones of the lines. A three phase program was conducted to devise preweld methods of preventing postweld rust on the interior surfaces of weld joints. The results indicated that proper preweld treatment, with optimum backup shielding, will prevent postweld rust in the line interior weld and heat affected zone. Author (NSA)

N71-14078# Oak Ridge National Lab., Tenn.

DP-1: ALGOL PROGRAM FOR THE CALCULATION OF THE ENERGY SPECTRA OF SCATTERED GAMMA-RAYS IN A PLANE SHIELDING LAYER

S. A. W. Gerstel [1970] 40 p refs Transl. into ENGLISH from German report BMBW-FBK-69-43 Sponsored by AEC
(ORNL-tr-2353; BMBW-FBK-69-43) Avail: NTIS

The ALGOL-program DP1 solves the equations of the double-P sub 1-approximation for the transport equation, which depends on space, angle and energy, in slab geometry for gamma rays. A summarized description of the formalism of the solutions with the listing of the complete ALGOL program is given. The main aim is the specification of input and output data. A detailed discussion is devoted to the numerical integration, which uses a generalized Simpson rule with nonequal integration steps for integrands with two discontinuities. The approach used, permits the explicit analytical formulation of the final result and could also serve as a first step towards a generalization to higher DP sub L-approximations. Author (NSA)

N71-14094# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.

SYSTEMATIC FAILURE STUDY OF REACTOR PROTECTION SYSTEMS

Sep. 1970 119 p refs
(BAW-10019) Avail: NTIS

The details of an analysis performed to verify the ability of the reactor protection system to deal with systematic or common mode failure are presented. The analysis was carried out by assuming that the first trip setpoint reached during the course of the accident fails to trip the reactor. The situations analyzed include the following: (1) rod withdrawal from power, (2) startup accident, (3) rod ejection accident, (4) loss-of-coolant flow, (5) dropped control rod, (6) emergency core cooling system actuation, and (7) secondary side malfunction (turbine trip; loss of feedwater flow). In general the results of the analyses are quite favorable. The protection system prevents gross system damage in any given accident situation, even when it is assumed that the primary trip mode has failed. Author (NSA)

N71-14095# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.

PLUTONIA/CURIA COMPATIBILITY TESTING Quarterly Report, Jul.–Sep. 1969

R. L. Andelin and J. D. Watrous Oct. 1969 22 p refs
(Contract AT(45-1)-2138)
(MDC-G-1665; QR-4) Avail: NTIS

The safe use of radioisotope fuels requires knowledge of the capability of materials to contain the fuel. Compatibility testing of isotope-container materials combinations at or above expected use temperatures is currently being performed. Most of the metallography was completed on refractory metal capsules containing the same PuO_2 after exposure at 1800 C for 2000 hours. Fifteen capsules containing a higher purity plutonia were fabricated. Twelve are being exposed at 1800 C. The remaining three are awaiting receipt of PuO(1.8) to provide comparative data. Plans were completed and preparations are underway to initiate testing of curium-244 sesquioxide early in the next quarter. Six plutonia-molybedum cermets were encapsulated. One capsule at each of two temperatures, 1800 and 2000 C, attained 1000 hours exposure and was removed for examination. The remaining four capsules will continue exposure to 5000 or 10,000 hours. Author (NSA)

N71-14096# Argonne National Lab., Ill.

REACTOR DEVELOPMENT PROGRAM Progress Report, Jul. 1970

27 Aug. 1970 173 p refs
(Contract W-31-109-eng-38)
(ANL-7726) Avail: NTIS

Highlights of project activities for July 1970 are summarized. LMFBR physics development, component development, materials technology, and safety studies are reviewed. Operations and analysis of ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects, vendor fuel element reclamation, and operations are summarized. Reactor fuels and materials development, physics studies, engineering development, fuel cycle chemistry, and TREAT operations are reported. NSA

N71-14101# Gulf General Atomic, San Diego, Calif.

PUBLIC SERVICE COMPANY OF COLORADO 330-MW(e) HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report, 1 Apr.–30 Jun. 1970

31 Jul. 1970 138 p refs
(Contract AT(04-3)-633)
(GA-10202; QPR-20) Avail: NTIS

Research activities centered on the development program for the Fort St. Vrain power reactor unit. Considered were physical parameters and fuel element design and management, fission product release, radiation effects on graphite, and irradiation testing of thorium carbide and uranium carbide coated particles. NSA

N71-14109# Battelle-Northwest, Richland, Wash.

PLUTONIUM UTILIZATION PROGRAM Quarterly Report, Mar.–May 1970

Jun. 1970 103 p refs
(Contract AT(45-1)-1830)
(BNWL-1442) Avail: NTIS

Radiochemical and mass spectrometric analyses of fuel samples taken from the PRTR batch core were completed, as well as the reanalysis of the plutonium lattice, space dependent, spectral measurements. Critical numbers of rods for Al-Pu-H_2O and UO_2-PuO_2-H_2O systems were measured. Dissolution studies with unirradiated cold press sinter UO_2 - 4 wt.% PuO_2 pellet fuel indicated that extensive solid solution formation occurs during fabrication such that the pellets are soluble in nitric acid. SPERT tests for PuO_2 particle size effect study and TREAT tests for cladding failure are reviewed. A new version of the nonlinear least squares fitting program LEARN, called LEARN-I-C, was written. The new version increases reliability and speed in the solution of difficult problems. J.A.M.

N71-14119# MSA Research Corp., Evans City, Pa.
EFFECT OF HIGH-TEMPERATURE SODIUM ON THE MECHANICAL PROPERTIES OF CANDIDATE ALLOYS FOR THE LMFBR PROGRAM: CALIBRATION AND OPERATION OF THE UNC OXYGEN METERS
W. J. Carter, R. J. Shreve, and S. J. Rodgers Apr. 1970 37 p ref
(Contract AT(11-1)-765)
(MSAR-70-56; Rept-15) Avail: NTIS

The performance of the oxygen meters was evaluated in both high purity and carbon-contaminated sodium. The response of a total of four cells was studied. The meters responded to oxygen activity in sodium resulting from changes in cold-trap temperatures and from atmospheric contamination introduced by putting mechanical properties test specimens on stream. The considerable scatter in the data was caused by lack of ambient temperature control and indeterminate analytical errors in samples containing less than 10 ppm oxygen. Early models of the oxygen meter were sensitive to ambient temperature changes. A more recent model did not show the ambient temperature sensitivity when tested in the high carbon loop. The effect of sodium temperature on the meter response is negligible when the temperature is controlled to + or −5 F. The presence of a high carbon activity did not adversely effect the response of the oxygen meter. Carbon activity was varied by three methods: cold-trap temperature, carbon-bed temperature and plugging-indicator operation. Author (NSA)

N71-14122# Atomics International, Canoga Park, Calif.
LMFBR PHYSICS PROGRAMS Annual Technical Progress Report, Government Fiscal Year 1970
T. H. Springer, R. J. Tuttle, H. N. Royden, L. A. Montford, R. K. Paschall et al 15 Aug. 1970 87 p refs
(Contract AT(04-3)-701)
(AI-AEC-12969) Avail: NTIS

Major emphasis was placed on experimental and analytical studies of control rod reactivity and heating effects as they pertain to full-scale FBR application. The experimental studies were conducted in a U-235 plate-fueled spherical core whose spectrum closely simulated that of conceptual FBR power plants. Some comparative investigations were also made in a sodium-voided version of the same type core. Special attention was paid to a comparison between the calculated and measured effects of the control rod systems studies so that analytical techniques for dealing with rather geometrically complex FBR control rods could be evaluated and modified to be more useful to the reactor designer. Author

N71-14133# Argonne National Lab., Ill.
COMPARISON OF THE VARIOUS NEUTRONIC REPRESENTATIONS FOR EBR-2 ANALYSES
J. T. Madell and R. E. Jerkins Feb. 1970 62 p refs
(Contract W-31-109-eng-38)
(ANL-7540) Avail: NTIS

The methods of preparing the input specifications for neutronic analyses of EBR-2 are described. The input specifications for one- and two-dimensional calculations include regional designations, volume fractions, atomic densities, and mesh intervals. The production, collapsing, and analyses of various cross-section sets are discussed. EBR-2 loadings with steel and depleted uranium subassemblies in the inner blanket were simulated for one- and two-dimensional calculations. The influence of diffusion and transport approximations and of several cross-section sets on neutronic quantities of these loadings is investigated for one- and two-dimensional calculations. The neutronic quantities obtained from various one-dimensional representations are compared to those obtained from a two-dimensional representation. Author (NSA)

N71-14148*# Aerojet-General Corp., Sacramento, Calif.
AN EXPERIMENTAL STUDY OF THE NOISE FIELD RESULTING FROM GROUND TESTING A NUCLEAR ROCKET ENGINE. NERVA PROGRAM
R. S. Feirell and W. R. Thompson 20 Oct. 1969 59 p refs
(Contract SNP-1)
(NASA-CR-111726; RN-TM-882) Avail: NTIS CSCL 21F

Experimental engine cold flow tests were conducted and posttest inspection showed evidence of damage that was caused by acoustic forces. To determine the magnitude and extent of the noise field resulting from ground tests of the rocket engine, a comprehensive investigation to identify the factors necessary to define the acoustics was conducted. The investigation was divided into four steps: (1) analytical predictions of the acoustic environment; (2) scale model tests to clarify the empirical factors required for analysis; (3) improvement of the facility components as required; and (4) acoustic measurements of the sound pressures during power tests. The fourth step is described in detail and the entire investigation is summarized. The experimental information, theoretical results, and full-scale test data are presented. Author (NSA)

N71-14153# Idaho Nuclear Corp., Idaho Falls.
EVALUATION OF BEARING LOADS AND CONTACT STRESSES IN THE PRIMARY COOLANT CHECK VALVE OF THE ADVANCED TEST REACTOR
N. R. Byers Jun. 1970 380 p refs
(Contract AT(10-1)-1230)
(IN-1338) Avail: NTIS

Bearing failures in the ATR primary coolant check valve occurred during final stages of testing and indicated that conditions could occur that would affect the safety and reliability of reactor operation. Bearing stresses due to a varying load, a criterion for bearing material, and a guide for future bearing design are presented. By a slight extension, this method may be used to predict bearing fatigue failure and bearing life. Author (NSA)

N71-14154# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, Feb.–Apr. 1970
Jun. 1970 148 p refs
(Contract AT(04-3)-189)
(GEAP-10028-34; QR-34) Avail: NTIS

Research progress is reported on development and testing of stainless steel clad plutonium oxide-uranium oxide fuel pins for fast ceramic and liquid metal fast breeder reactors, the effects of fast neutrons on plutonium-uranium oxide fuel elements and stainless steel cladding, and the performance of defected plutonium-uranium oxide fuel elements in flowing sodium. NSA

N71-14156# Union Carbide Nuclear Co., Oak Ridge, Tenn.
NUCLEAR SAFETY ANALYSIS OF MODERATION-CONTROLLED 48-INCH I.D. HEAVY WALL UF_6 CYLINDERS
C. E. Newton and R. G. Taylor 10 Aug. 1970 12 p refs
(Contract W-7405-eng-26)
(K-L-6255) Avail: NTIS

The analysis includes cylinder data, information on hydrogen moderation control, criticality safety, array safety, and data correlations. Analytical results show that the cylinders appear to be safe at U-235 enrichments to 4.5% under moderation control. NSA

N71-14160# Union Carbide Corp., Tonawanda, N.Y. Linde Div.
THE DESIGN, DEVELOPMENT, AND DELIVERY OF HIGH TEMPERATURE VACUUM INSULATION SYSTEMS FOR SNAP-21 THERMOELECTRIC POWER SYSTEMS Final Report

L. R. Niendorf 1969 22 p
(Contract AT(30-1)-3691)
(TID-25482) Avail: NTIS

The high temperature vacuum insulation system developed for the SNAP-21 10 W thermoelectric power system has the dual purpose of supporting the 265-pound biological shield while allowing minimum heat loss from the nuclear fuel. It is hermetically sealed and incorporates chemical getters to maintain a hard vacuum for five years. The biological radiation shield is supported by a thin-walled neck tube at the generator end and three ball joint tension support rods at the other end. The insulation has demonstrated design ruggedness by withstanding vibration loadings of 3 g up to 50 Hz and 6 g shock loadings at 6 milliseconds duration (saw tooth peak) while at an operating temperature of 1285 C. A thermal heat loss for the insulation system of less than 50 watts has been achieved. Author (NSA)

N71-14161# Oak Ridge National Lab., Tenn.
SPRAY, MIST, BUBBLES, AND FOAM IN THE MOLTEN SALT REACTOR EXPERIMENT
J. R. Engel, P. N. Haubenreich, and A. Houtzeel Jun. 1970 102 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3027) Avail: NTIS

The fuel pump bowl in the MSRE incorporated a ring from which 50 gpm of salt was sprayed through the cover gas and into the salt pool. The device effectively removed Xe from the fuel as intended, but also produced several incidental effects. Although none seriously interfered with operation, considerable effort was spent on elucidation of these effects. The spray produced a mist of salt droplets, some of which drifted into the offgas line at a rate of a few grams per month. The resultant salt deposits required clean-out at intervals of six months to a year. The stripper jets also drove bubbles several inches into the salt pool, reducing the average density and raising the actual level above that indicated by the bubbler level elements. Some salt transferred into the over-flow line, apparently as froth although there was no evidence of persistent foam. Most of the bubbles driven into the salt returned to the surface, but a small fraction was drawn into the circulating loop. The situation was such that small changes in pump speed or physical properties of the salt changed the depth of the bubble zone enough to change the volume fraction of gas in the loop over the range from 0.02% to 0.7%. Author (NSA)

N71-14164# Oak Ridge National Lab., Tenn.
ORNL NUCLEAR SAFETY RESEARCH AND DEVELOPMENT PROGRAM BIMONTHLY REPORT, MAY–JUNE 1970
William B. Cottrell Sep. 1970 162 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3061) Avail: NTIS

Progress is reported on the Nuclear Safety Program at ORNL. Much of this work is in general support of water-cooled power reactor technology, and reflects current safety problems. Measurements of prompt fuel element failure phenomena, the efficacy of containment-spray, and pool-suppression systems for fission product removal are considered. Studies on the removal of accident released fission products and aerosols from gas streams by filters and adsorbers are also included. Several projects were conducted in support of the high temperature gas-cooled reactor (HTGR) and liquid-metal fast breeder reactor (LMFBR) programs. Other major projects involved primary piping, steel pressure-vessel technology, and seismic design consideration. Particular emphasis was placed on environmental effects in connection with these projects. Author

N71-14167# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
BURNUP DATA FROM UO2–0.48 WT % Pu-O2 FUEL
R. P. Matsen Aug. 1970 75 p
(Contract AT(45-1)-1830)
(BNWL-1488) Avail: NTIS

Burnup data obtained from the destructive analysis of UO2–0.48 wt % PuO2 fuel irradiated in the Plutonium Recycle Test Reactor are presented. The measured data are partially analyzed, however no effort has been made to detect questionable data. Author (NSA)

N71-14170# Atomics International, Canoga Park, Calif.
SNAP 8, CONTROL DRUM BEARING DEVELOPMENT AND EVALUATION HISTORY
P. H. Horton 15 Aug. 1970 90 p refs
(Contract AT(04-3)-701)
(AI-AEC-12964) Avail: NTIS

Development and testing of the SNAP 8 control drum bearings are traced from initial material selection through final design verification testing. Design of the self-aligning journal bearings relied on technology from previous SNAP 10 bearings, with material and dimension changes for operation under increased load, temperature, and life. The final design bearings, using a carbon-graphite against alumina bearing couple, successfully completed in excess of 78,000 total hours at test, with individual tests of 12,000 hr duration. Author (NSA)

N71-14172# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FAST FLUX TEST FACILITY Periodic Technical Report, Mar.–Jun. 1970
C. P. Cabell, comp. Aug. 1970 183 p refs
(Contract AT(45-1)-2170)
(BNWL-1394) Avail: NTIS

Progress is described in the discipline-oriented technological program being conducted to ensure technical adequacy of the FFTF design. The material presented is arranged by chapters and includes the following headings: (1) plant design; (2) reactor components; (3) instrumentation and controls; (4) sodium technology; (5) core design; (6) fuels and materials; (7) fuels recycle; (8) reactor physics; and (9) reactor safety. D.L.G.

N71-14182# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, Period Ending 31 Mar. 1970
P. Patriarca, comp. and D. J. Rucker, ed. Aug. 1970 290 p refs
(Contract W-7405-eng-26)
(ORNL-4560) Avail: NTIS

Research progress is reported on the following: nondestructive testing techniques for LMFBR, sodium corrosion of advanced refractory metals, development of materials for steam generators, stainless steel tubing and welding techniques for LMFBR vessels and components, cladding materials for space isotopic heat sources, physical and mechanical metallurgy of refractory alloys, development of fast reactor oxide fuels, effects of power cycling on LMFBR fuel cladding behavior, development of fast reactor neutron-absorber materials, radiation effects of fast neutrons on electrical insulators, and physical properties of fuel elements and refractory materials exposed to irradiation. NSA

N71-14183# Westinghouse Electric Corp., Madison, Pa. Advance Reactor Div.
COST OPTIMIZATION AND PARAMETRIC STUDIES, WESTINGHOUSE 100-MWe LMFBR
A. H. Redding, M. Dyos, and J. D. Mangus [1970] 164 p refs
Prepared for Argonne Natl. Lab.

(WARD-2000-98) Avail: NTIS

Results of the FABROC and SFBRODT computer programs for optimum economic parameters of the conceptual 1000 MW(e) LMFBR are presented. Optimization calculations include: fuel cycle, coolant loops, power conversion systems, and piping systems. NSA

N71-14192# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.

PLUTONIA/CURIA COMPATIBILITY TESTING Quarterly Report, Oct. – Dec. 1969

R. L. Andelin and J. D. Watrous Jan. 1970 15 p refs

(Contract AT(45-1)-2138)

(MDC-G-1675; QR-5) Avail: NTIS

Compatibility testing of relatively impure plutonia-238 in contact with six molybdenum, tungsten, and rhenium containing alloys at 1800 and 2000 C has shown that oxygen content of the plutonia affects reaction rates, and that significant amounts of oxygen are lost through the molybdenum alloy container walls. Further testing is currently underway with a higher purity plutonia representative of current production-grade material. Curia-244 has been encapsulated in primary containers with contamination free external surfaces for exposure at 2000 C. This approach, also used in the plutonia effort, provides a significant improvement in the determination of damage to the primary capsule. Plutonia-molybdenum cermets exposed for 1000 hours at 1800 and 2000 C in closed containers released approximately 40% of the stored helium. Longer duration exposure continues. Author (NSA)

N71-14193# Atomic Power Development Associates, Inc., Detroit, Mich.

SODIUM-WATER REACTIONS RELATED TO LMFBR STEAM GENERATORS: PROJECT SUMMARY

H. V. Chamberlain Jun. 1970 63 p refs

(Contract AT(11-1)-865)

(APDA-257) Avail: NTIS

Sodium-water reactions are investigated relative to the development of safe, reliable, and economic Na heated steam generators for the LMFBR program. This program included the development of: data needed to estimate the extent of tube wastage and to determine the dominant system parameters affecting tube wastage during a small leak of water into Na; criteria needed to evaluate systems for detecting a small leak of water into Na; and a mathematical model for predicting the behavior of large Na-water reactions in a Na-heated steam generator. Author (NSA)

N71-14195# Los Alamos Scientific Lab., N.Mex.

PLUTONIUM CARBIDES

A. E. Ogard and J. A. Leary Mar. 1970 6 p refs

(Contract W-7405-eng-36)

(LA-4415) Avail: NTIS

The preparation and properties of the plutonium carbides are reviewed. The phase diagram for the C–Pu system is given. NSA

N71-14206# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

CORE CLAMPING SYSTEM DESIGN FOR FAST REACTORS

G. R. Waymire and R. J. Jackson May 1970 47 p refs Presented at the Winter Meeting of the Am. Nucl. Soc., San Francisco, 30 Nov.–4 Dec. 1969

(Contract AT(45-1)-1830)

(BNWL-SA-2691; CONF-691102-27) Avail: NTIS

The advent of irradiation-induced effects in candidate structural materials for fast reactors has resulted in a reassessment of in-reactor structural requirements for liquid metal fast breeder reactors, particularly in the area of core clamping. Criteria for core clamping design are proposed. Phenomena resulting in core structural problems are reviewed. The design approaches being pursued for the fast test reactor of the fast flux test facility are described. Author (NSA)

N71-14208# Technische Hochschule Stuttgart (West Germany). Inst. fuer Kernenergetik.

THE 1968 RESULTS FROM BMwF SUPPORTED STUDIES OF THE IKE. PART 1: CONTINUATION OF BASIC RESEARCH STUDIES ON THERMIONIC REACTORS FOR SPACE FLIGHT PURPOSES. PART 2: STUDIES ON NEUTRON AND GAMMA RAY INTERACTIONS WITH MATTER. CALCULATIONS FOR COMPACT REACTORS, ESPECIALLY WITH PLUTONIUM FUEL [ERGEBNISSE DER 1968 VOM BMWF GEFOERDERTEN ARBEITEN DES IKE. TEIL 1: FORTFUEHRUNG VON GRUNDLAGENUNTERSUCHUNGEN UEBER THERMIONIKREAKTOREN FUER RAUMFLUGZWECKE. TEIL 2: UNTERSUCHUNG DER WECHSELWIRKUNG VON NEUTRONEN- UND GAMMASTRAHLEN MIT MATERIE. BERECHUNG VON KOMPAKTREAKTOREN, INSBESONDERE MIT PLUTONIUM ALS BRENNSTOFF]

K. H. Hoecker May 1969 58 p refs In GERMAN Supported by BMwF

(K-12) Avail: NTIS

An apparatus for heat conductance measurements is constructed and obtained results are given. The application of newly developed heat pipes in a nuclear spaceship reactor concept is discussed and results from a liquid metal pipe-radiator study are considered for design optimization. Quantitative measurements of properties in the surface ionization region of thermionic converters and spectral measurements in the contact ionization region are used to determine plasma dimensions between the electrodes. Also described is a method for producing high purity cesium. A diffusion theoretical analysis for evaluating the nuclear reactivity potential of plutonium fuel in thermionic reactors is in progress; this method considers two dimensional anisotropic scattering and the application of pertinent Monte Carlo programs. Transl. by G.G.

N71-14217# Institutt for Atomenergi, Halden (Norway).

THEORETICAL ANALYSIS OF BURNUP EXPERIMENTS WITH THE HBWR SECOND FUEL CHARGE

K. Ekberg and S. E. Wennemo-Hansson Feb. 1970 22 p refs

(HPR-116) Avail: AEC Depository Libraries

A series of in-pile and out-of-pile experiments to determine burnup characteristics was conducted in 1966 with the second fuel charge of the Halden Boiling Heavy Water Reactor. The experiments were performed in order to obtain results against which theoretical reactor physics models for heavy water lattices could be tested. The average burnup for the fuel at the time of the experiments was 5430 MWd/tU. The results of the theoretical analysis related to the above experiments are presented. The comparison of calculated and measured data comprises the following items: isotopic composition of the burned fuel, critical size of the core and reactivity coefficients at low power, and reactivity effects induced by power changes. The experimental and theoretical results for the burned fuel are compared with the corresponding results for the unburned core. Author (NSA)

N71-14237# Technische Hogeschool, Eindhoven (Netherlands).

ON THE MASS AND ENERGY EXCHANGE BETWEEN INTERACTING WATER-CHANNELS

T. van der Roe and M. Bogaardt Jul. 1969 22 p refs

(WW-18-R-150) Avail: AEC Depository Libraries

Single phase liquid mass and energy exchange experiments were carried out in a transparent test section presenting two

adjacent channels with variable gap width and shape at atmospheric pressure and in a high pressure rig with a test section consisting of a four rod cluster at conditions close to average PWR operating conditions. In both test sections, either one or two channels were electrically heated over a large part of the axial length, and the amount of mixing was determined by measuring the amount of enthalpy increase in one channel. The ratio of the overall eddy diffusivity for heat and the kinematic viscosity has been determined as a function of the Reynolds number for different gap geometries. Also radial temperature measurements have been conducted halfway the length of the transparent channels to measure rapid fluctuations as well as average conditions integrated over 1 sec. Author (NSA)

N71-14290# Michigan Univ., Ann Arbor.
EDUCATIONAL AND RESEARCH ACTIVITIES, 1 JANUARY–31 DECEMBER 1969
May 1970 22 p refs
(Contract AT(11-1)-385)
(COO-385-3) Avail: NTIS

During 1969, the Ford Nuclear Reactor (FNR) continued to serve as an integral part of the educational and research activities of the University of Michigan. It also served other schools, hospitals, and industrial research organizations. By maintaining the continuous operating schedule of the reactor for the majority of the year and by improving laboratory and reactor irradiation facilities, the amount and types of services available to facility users were extended. Operations during 1969 are reviewed. Author (NSA)

N71-14295# Argonne National Lab., Ill.
PRELIMINARY SYSTEM DESIGN DESCRIPTION OF THE EBR-2 IN-CORE INSTRUMENT TEST FACILITY
E. Hutter and O. Seim Jun. 1970 58 p ref
(Contract W-31-109-ENG-38)
(ANL/EBR-23) Avail: NTIS

The EBR-2 In-core Instrument Test Facility (INCOT) provides the means of inserting instrument sensors into the EBR-2 core, exposing them to a fast neutron flux of 2×10 to the 15th power nv, and monitoring their performance during their experimental life. The facility includes a thimble assembly that serves as a container for one of three basic types of sensor assemblies, which hold the test sensors during irradiation. Shielded handling containers make it possible to remove individual tests or experiments from the facility and to remove parts of the facility itself. A system for transmitting sensor data carries the sensor signals to the instrument readout and data-logging equipment. The facility, the principles of operation, and pertinent safety precautions are described. Author (NSA)

N71-14356# Pennsylvania State Univ., University Park. Dept. of Nuclear Engineering.
NUCLEAR REACTOR FACILITY Annual Progress Report, 1 Jul. 1969 – 30 Jun. 1970
Jun. 1970 62 p refs
(Contract AT(30-1)-1859)
(NYO-1859-16; APR-15) Avail: NTIS

Operations and maintenance requirements for the Penn State TRIGA Reactor are presented. Research projects conducted in the facility are described. NSA

N71-14357# Gulf General Atomic, San Diego, Calif.
HEAD-END SEPARATION OF TRISO COATED FISSILE AND FERTILE PARTICLES FOR HIGH-TEMPERATURE GAS-COOLED REACTORS
S. Langer, N. Baldwin, and H. R. Phillips Jun. 1970 12 p refs
(Contract AT(04-3)-167)
(GA-9258) Avail: NTIS

Preliminary studies indicated that the separation of U-233 from U-235 during head-end reprocessing of HGTR fuels of TRISO-coated (contains SiC layer) fissile and fertile particles is feasible. The SiC layer was strong enough to withstand pressure of fission gases at 800 C. Irradiation had a negligible effect on the integrity of the SiC layer. Uranium retention in alumina bed material was negligible. NSA

N71-14359# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
HOT-MICROHARDNESS VALUES FOR METALS AND ALLOYS (IRRADIATED AND NONIRRADIATED)
J. L. Kamphouse, D. A. Myers, and J. Moteff Dec. 1969 59 p
(Contract AT(40-1)-2847)
(GEMP-716) Avail: NTIS

Data on the hot hardness of irradiated and unirradiated refractory metals and alloys of interest in nuclear technology are presented. The data are useful in determining temperature regions in which pronounced changes occur in the plastic properties of these materials. NSA

N71-14368# Battelle-Northwest, Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES FIXATION OF RADIOACTIVE RESIDUES Quarterly Progress Report, May–Jul. 1970
A. G. Blasewitz, ed. Aug. 1970 24 p
(Contract AT(45-1)-1830)
(BNWL-1494) Avail: NTIS

Radioactive demonstrations in WSEP have been completed with simulated wastes containing approximately 48 MCi of mixed radionuclides being converted to solids. During the report period, the thirteenth and final spray solidification demonstration run in WSEP was completed. A simulated PW-4m waste (a low salt, high fission product waste resulting from the reprocessing of a power reactor fuel with an exposure of 45,000 MWd/tonne at 30 MW/tonne) was successfully reduced to a solid having a heat rate density of 200 W/liter via the in-pot melting technique. Spray calcined PW-4m waste was melted directly with a borosilicate glass frit in the final storage container at a processing rate of about 1.1 tonne/day which is an 80% higher rate than was obtained for this waste type during previous spray solidification runs using the platinum melter. Author (NSA)

N71-14371# Metaalinstituut TNO, Delft (Netherlands).
A NEW DETERMINATION OF THE EMBRITTLEMENT IN STEEL USING SMALL SPECIMENS (APPROXIMATELY 0.2 cc) IN PARTICULAR WITH RESPECT TO IRRADIATION Progress Report, 1 Jan. – 31 Dec. 1969
C. Koning 5 Feb. 1970 25 p
(Contract EURATOM-060-64-11-TEEN)
(EURAEC-2139; EUR-4029; M70-76) Avail: NTIS

Specimens of five different reactor pressure vessel steels for stress wave attenuation (S.A.T.) and tensile tests were irradiated in the BR2-reactor. Two fast neutron doses (>0.1 MeV) were used, viz. approximately 2.5×10 to the 19th power and approximately 8.3×10 to the 20th power n per centimeter squared at an irradiation temperature of 285 C, corresponding with a representative service temperature of boiling water reactors. After a cooling time and dismantling from the irradiation capsules, the specimens were tested. The relative energy absorption versus temperature curves at performance of the S.A.T. decrease after irradiation of the specimens at 285 C as was expected. However, the shifts in transition temperature proved negative. A possible explanation for this phenomenon is suggested. Author (NSA)

N71-14374# Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div.

THE 1000-MWe LMFBR FOLLOW-ON STUDY. TASK 2 AND 3. VOLUME 3: CONCEPTUAL SYSTEM DESIGN DESCRIPTIONS (SECTIONS 8–14) Final Report

Feb. 1969 444 p refs Prepared for Argonne Natl. Lab.
(BAW-1328-Vol-3) Avail: NTIS

Individual conceptual system design descriptions (CSDDs) for the reference 1000 MW(e) LMFBR central station power plant are presented. The CSDDs included are: (1) reactor auxiliary, (2) intermediate coolant, (3) steam generator, (4) energy conversion, (5) instrumentation and control, (6) electrical, and (7) safety systems. NSA

N71-14381# Atomics International, Canoga Park, Calif.

A 1000-MWe LIQUID METAL FAST BREEDER REACTOR FOLLOW-ON STUDY CONCEPTUAL DESIGN REPORT. VOLUME 1: SUMMARY

[1970] 89 p refs Prepared for Argonne Natl. Lab.
(AI-AEC-12792-Vol-1; DWR-1215) Avail: NTIS

The final reference design for a 1000 MW(e) sodium-cooled fast breeder reactor is described. The reactor consists of a cylindrical core with 274 PuO2-UO2 fuel elements, 15 tantalum control rods, two rows of depleted UO2 blanket elements, and a row of stainless steel reflector elements. The plant features 1140 F reactor outlet temperature, a hockey-stick configuration steam generator, a three-loop heat transfer system with one intermediate heat exchanger per loop, and a 3600-rpm tandem-compound turbine generator. A plant capital cost estimate, a fuel cycle cost analysis, and an overall economic assessment of the final reference design are presented. NSA

N71-14382# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

FLOW INDUCED TEMPERATURE AND PRESSURE PULSATIONS IN ROD BUNDLES

J. Kadlec and W. Lang Apr. 1970 20 p refs Presented at Int. At. Energy Agency Symp. on Progr. in Sodium-Cooled Fast Reactor Eng., Monaco, 23–27 Mar. 1970 Sponsored by US/EURATOM
(EURFNR-784; KFK-1157; SM-130/41; CONF-700307-6) Avail: AEC Depository Libraries

Experiments are described, which are carried out to investigate the random pressure and temperature pulsations of a coolant flow and their consequences. Water circuit experiments with a fuel subassembly provided an indication of the correlation between pressure fluctuations and vibrations of the fuel pins. The temperature pulsations were investigated in a sodium loop. A description is given of the test facilities and the test results. Author (NSA)

N71-14400# Atomic Energy Establishment, Winfrith (England).

DRYOUT TESTS ON AN INTERNALLY HEATED ANNULUB WITH VARIATION OF AXIAL HEAT FLUX DISTRIBUTION

R. B. Little May 1970 78 p refs
(AEEW-R-578) Avail: AEC Depository Libraries

The results of dryout tests are reported where three types of nonuniform heat flux distribution were studied and the results compared with data from a uniform axially heated test section of the same nominal geometry. The studies were completed on an annular geometry with an inner 0.626 in. diameter, 12 ft long heated rod positioned in an unheated 0.826 in. shroud tube. The tests involved water coolant at pressures of 750 and 1,000 lbf/sq in. with mass velocities between 1 and 3 million lb/hr sq ft. Three different methods of dryout detection instrumentation were used and the studies also covered a 4:1 range of heater tube wall thickness. Author (NSA)

N71-14401# International Atomic Energy Agency, Vienna (Austria).

MEETING OF SPECIALISTS ON SODIUM VAPOR CONTROL

20 Mar. 1970 26 p Conf. held at Cadarache, France, 19–20 Mar. 1970
(NP-18331) Avail: AEC Depository Libraries

Information related to the characteristics and control of Na vapor in liquid metal-cooled fast reactor cooling systems is presented. Problems with cool gas systems are discussed. NSA

N71-14406# Oak Ridge National Lab., Tenn.

QUALITY-ASSURANCE PRACTICES IN CONSTRUCTION AND MAINTENANCE OF THE MOLTEN-SALT REACTOR EXPERIMENT

B. H. Webster Apr. 1970 106 p Sponsored by AEC
(ORNL-TM-2999) Avail: NTIS

The MSRE was built at Oak Ridge National Laboratory to demonstrate the practicality of the molten-salt reactor concept. Site construction and installation of auxiliary systems were by outside contractors, while the primary reactor systems were installed by ORNL forces. Design, procurement, construction, and maintenance followed ASME codes, ORNL practices, and special procedures developed for the MSRE by the ORNL reactor division group primarily responsible for quality assurance. The quality assurance program, the problems that were encountered, and the lessons that were learned are presented. Four years of reliable operation of the MSRE proved the success of the quality-assurance program. Author (NSA)

N71-14407# Atomic Power Development Associates, Inc., Detroit, Mich.

AEC SPONSORED ACTIVITIES Quarterly Technical Progress Report, Apr.–Jun. 1970

Jun. 1970 56 p refs
(Contract AT(11-1)-865)
(APDA-262) Avail: NTIS

Tube wastage by sodium-water reactions in steam generators is analyzed. Test results for Cr-Mo-steel tubes are presented. Acoustic detection devices are described for sodium-water experiments. Impurity monitors for liquid sodium systems are described. A comparison of methods for calculating and measuring heterogeneity effects in fast critical assemblies and power reactors is presented. NSA

N71-14408# Los Alamos Scientific Lab., N.Mex.

THE 3DDT: A THREE-DIMENSIONAL MULTI-GROUP DIFFUSION-BURNUP PROGRAM

John C. Vigil Feb. 1970 41 p refs
(Contract W-7405-eng-36)
(LA-4386) Avail: NTIS

The 3DDT is a three-dimensional multigroup diffusion theory code. It can be used to compute k sub eff or to perform criticality searches on reactor composition, time absorption, or reactor dimensions by either the regular or the adjoint flux equations. Material burnup and fission production buildup can be computed for specified time intervals, and criticality searches can be performed during burnup to compensate for fuel depletion and fission product growth. All programming is in FORTRAN-4 and variable dimensioning is used to make maximum use of available core storage. Because variable dimensioning is used, no simple restrictions can be placed on individual components of the problem. However, a 18-group problem containing 30 × 30 × 30 mesh points and 80 zones can be accommodated on a 65k computer. Execution times are about 0.01 sec per mesh point per group for a k sub eff calculation on a CDC 6600 computer. Author (NSA)

N71-14409# Battelle Memorial Inst., Columbus, Ohio.
A SURVEY OF LMFBR COMPONENT MATERIALS LIMITATIONS AND REQUIREMENTS
Arthur A. Bauer and Jack G. Conner Jan. 1970 140 p refs
(Contract W-7405-eng-92)
(BMI-1901) Avail: NTIS

The materials needs for selected LMFBR components, operating with sodium coolants at temperatures up to 1200 F, the functions, general design, operating characteristics, history of materials selection, and materials problems and limitations for the coolant transport system, pumps, intermediate heat exchanger and steam generator, control rod drive and fuel-handling mechanisms, and core components are reviewed. Major materials requirements identified are associated with the need for mechanical property design data, the problems and materials limitations resulting from corrosion and mass transfer in sodium, the evaluation and selection of wear-resistant materials for guide, bearing, and seal applications, the development of techniques to weld reliable tube-to-tube sheet joints, and the irradiation-induced swelling and ductility loss of structural materials exposed to a fast-neutron-flux environment.
Author (NSA)

N71-14410# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EXPERIMENTAL STUDY OF A GAS FLOW NEAR A FLAT SURFACE FITTED WITH FINS INCLINED WITH RESPECT TO THE DIRECTION OF GAS FLOW [ETUDE EXPERIMENTALE D'UN ECOULEMENT DE GAZ VOISINAGE D'UNE PAROIS PLANE MUNIE D'AILETTES INCLINEES PAR RAPPORT A LA DIRECTION DE L'ECOULEMENT]
Nicole Juignet Aug. 1970 108 p refs In FRENCH
(CEA-N-1329) Avail: AEC Depository Libraries

In nuclear gas-graphite power reactors, the heat exchange between fuel elements and cooling gas was improved by use of cylindrical cans fitted with cooling fins in a herring-bone pattern. An experimental study was made of the gas flow by analyzing the distribution of velocity vectors between the fins and the main gas flow; this was done on a full-scale model of a section of the can. These aerodynamic study and heat transfer tests showed the origins of the thermal anomalies observed on these surfaces and their distribution law along a set of cartridges. A study was also made of the influence of the size of the slot between the can sectors and of the channel diameter on both the thermal anomalies and on the average exchange coefficient level. Author (NSA)

N71-14412# Battelle-Northwest, Richland, Wash.
SODIUM TECHNOLOGY Quarterly Report, Jul.–Sep. 1969
Nov. 1969 140 p refs
(Contract AT(45-1)-1830)
(BNWL-1200-1) Avail: NTIS

Design of a prototype applications loop was initiated. The system is to provide a testing and development sodium system for sodium chemical technology research. A mockup facility for the development of remote methods of analysis for sodium is under construction. The air atmosphere portion was completed and equipped with manipulators. Programs were begun to extend present analytical capabilities to include methods for carbon containing species and particulates in sodium. The sodium coolant studies were directed at the FFTF primary and closed loop recovery from deleterious effects of radioactive corrosion products and fuel failures. A model which defines fuel failure modes, significant physical and transport properties of released materials, and the couplings between failure mode and contamination behavior was developed. High density, single phase 0.71 ThO2-0.29 YO(1.5) solid electrolyte samples of high purity were successfully fabricated. These samples are entirely single phase with no evidence of high yttria or Al2O3 second phases at grain boundaries. J.A.M.

N71-14414# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaire.
POWER DISSIPATED IN THE GRAPHITE AND THE CO2 OF A GRAPHITE REACTOR CELL [PUISSANCE DISSIPEE DANS LE GRAPHITE ET LE CO2 D'UNE CELLULE DE PILE A GRAPHITE]
Bertrand Barre, Jacques Brisbois, Michel Lott, Yves Oceraies, Jean-Paul Noel et al Jun. 1970 150 p In FRENCH
(CEA-R-3985) Avail: AEC Depository Libraries

The experiments carried out in the NAIADE 2 subcritical assembly are described. They concern the ionization of CO2 in the fuel channel and the graphite pores. The experimental work is effected in the moderator with ionization chambers of graphite filled with CO2, and of polythene filled with ethylene, and in the channel with a chamber containing the fuel element. The results are compared with the theoretical results obtained with the methods used in power reactor calculations. The observed agreement is excellent, the dispersion of about 5% being of the same order as the experimental uncertainties. Author (NSA)

N71-14417*# Aerojet Liquid Rocket Co., Sacramento, Calif.
CARBON COMPOUNDS/LIQUID HYDROGEN FUELS Final Report
E. M. Vander Wall Oct. 1970 96 p refs
(Contract SNP-1)
(NASA-CR-115818; FR02-W396) Avail: NTIS CSCL 18E

An experimental program was conducted to determine the feasibility of preparing suspensions of colloidal-size hydrocarbon particles in liquid hydrogen. The ultrafine hydrocarbon particles were prepared in-situ by injecting hydrocarbon/hydrogen gas mixtures into liquid hydrogen under static and flowing conditions. Several hydrocarbons were evaluated for use in the suspensions; cyclopropane proved to be the most attractive candidate. Eventually agglomeration of the hydrocarbon particles led to the settling of the suspensions. Concurrently, the use of very small particles of hydrocarbons as particulate gelants for liquid hydrogen was investigated. The particles were prepared in-situ using similar techniques; ethane was found to possess the greatest gelling capacity for liquid hydrogen. Stable gels were prepared with as little as 10 weight percent ethane. A stable gel of slush hydrogen required no more than 4 weight percent ethane. The flowability of the gels was demonstrated and the viscosity and yield stress values determined.
Author

N71-14423# Atomic Energy Commission, Oak Ridge, Tenn.
SYMPOSIUM ON ENGINEERING WITH NUCLEAR EXPLOSIVES, VOLUME 1
May 1970 858 p refs Symp. held at Las Vegas, Nev., 14–16 Jan. 1970; Sponsored by Am. Nucl. Soc.
(CONF-700101-Vol-1) Avail: NTIS

Fifty symposium papers are presented covering: (1) the plenary session which reviewed the Plowshare program, (2) underground nuclear effects, (3) excavation, (4) radioactivity, and (5) oil and gas research. E.C.

N71-14424# Atomic Energy Commission, Oak Ridge, Tenn.
SYMPOSIUM ON ENGINEERING WITH NUCLEAR EXPLOSIVES, VOLUME 2
May 1970 927 p refs Symp. held at Las Vegas, Nev., 14–16 Jan. 1970; Sponsored by Am. Nucl. Soc.
(CONF-700101-Vol-2) Avail: NTIS

Sixty-two papers are presented covering: (1) mineral recovery, (2) nuclear operations, (3) seismic effects, (4) water resources development, (5) scientific applications, (6) underground engineering applications, (7) underground nuclear effects, (8) nuclear excavation effects, (9) and radioactivity. E.C.

N71-14449# Oak Ridge National Lab., Tenn.
POSTIRRADIATION EXAMINATION OF FUEL ELEMENTS FROM CORE 1 AND CORE 2 OF THE ARMY SM-1A STATIONARY MEDIUM POWER REACTOR
A. E. Richt and V. O. Haynes Aug. 1970 95 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2987) Avail: NTIS

Fuel elements from the first two expended cores for the Army SM-1A stationary medium-power reactor at Ft. Greely, Alaska were examined to determine the cause of excessive radioactivity in the plant spent-fuel pit facility from core 1 fuel elements and to provide basic performance data for UO2-SS dispersion flat-plate fuel. Examinations were made on all the fuel elements to identify those to be given detailed examination including destructive evaluations. Unusual surface deposits were observed on core 1 fuel elements and cladding failures were found that allowed internal corrosive attack of the fuel-dispersion. In fact, enough fission products had been leached from such regions that the missing material was evidenced by depressions in the gamma scan activity. Detailed and summary information of the examination is presented. The most likely reason for the release of fission products to the spent-fuel pit water is a pitting-type corrosion that was most likely caused by impurities in the spent-fuel pit water. Author (NSA)

N71-14485# Institute of Nuclear Research, Warsaw (Poland).
TEMPERATURE MEASUREMENTS OF THE EK-10 TYPE REACTOR FUEL RODS IN EWA-4 CORE
J. Aleksandrowicz, M. Czerniewski, and L. Labno 1970 48 p refs
(INR-1170) Avail: AEC Depository Libraries

The measurement program of temperature of the EK-10 type of reactor fuel rods in steady and transient states of heat transfer conditions has been performed with EWA-2 and EWA-4 cores. Results of measurements performed with EWA-2 core were reported previously. The measurement results obtained in experiments performed with EWA-4 core are presented. The EWA-4 core consisted of fuel assemblies equipped with variable cross-section tubes inside of which the fuel rods had been placed. Two instrumented fuel rods were applied for measurements: one equipped with 5 surface thermocouples installed in the fuel cladding, and the second equipped with thermocouple for fuel rod core temperature measurement. In steady state, the EK-10 fuel temperature was measured for different cooling conditions and different reactor power levels. Transient tests were initiated by cooling water flow stopping and by ramp-reactivity addition into the core. Author (NSA)

N71-14488# Atomic Energy Establishment, Winfrith (England).
CALEB: A THREE-DIMENSIONAL FLUX SYNTHESIS CODE FOR FUEL MANAGEMENT STUDIES IN SGHWR's
G. S. Robinson and F. J. Fayers Aug. 1969 52 p refs
(AEEW-R-620) Avail: AEC Depository Libraries

The CALEB code embodies a special variant of flux synthesis which has been found successful for computing the three-dimensional complexities of fuel management schemes in SGHWRs. The synthesis involves separating the three-dimensional flux distribution into a slowly varying axial component coupled to a mean two-dimensional component in the x-y plane. This choice of synthesis is particularly effective for dealing with the power-dependent feedbacks associated with void, Doppler, and xenon distributions. The basic equations and numerical methods adopted in the flux and hydraulic solutions and the results of numerical tests of speed and accuracy are presented. Some special features of the code include the ability to study the use of variation of reactor flow to control reactivity or power distribution in reactors with a large void coefficient, such as the natural uranium SGHWR. Author (NSA)

N71-14487# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
IRRADIATION DEVICE ODILE [DISPOSITIF D'IRRADIATION ODILE]
Denis Fages, Jean-Claude Lauthier, Jacques Leclerc, and Andre Lhermenier Jun. 1970 51 p refs In FRENCH
(CEA-N-1317) Avail: AEC Depository Libraries

For experimental irradiations of fast reactor project fuels, a device to be used in pool type reactors, Osiris or Siloe, was designed and fabricated. Its main features are: static sodium cooling, the sodium being always kept liquid by electrical heaters; temperature adjustment by variable thermal barrier; flux adjustment by moving towards reactor core; and the ability to take neutrographies. Capable of evacuating more than 800 W/cm for small elements, the device Odile meets most of the requirements for fast reactor project irradiations. Author (NSA)

N71-14489# Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Centro di Calcolo.
HETEROGENEITY EFFECTS ON THE ADJOINT FUNCTION AND RELATED QUANTITIES IN FAST REACTORS
G. Bitelli, G. Cecchini, and A. Gandini 1970 19 p refs
(RT/FI-(70)19) Avail: AEC Depository Libraries

A method using collision techniques is developed which accounts for the heterogeneous effects on the adjoint function in the cell structure of fast reactors. A numerical example is shown relevant to the sodium void experiments on assembly 4Z of the ZPR 6 critical facility. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-13631# European Organization for Nuclear Research, Geneva (Switzerland).
A PULSED POWER SUPPLY (100 V, 13000 A) FOR SEPTUM MAGNETS
F. Depping 10 Jul. 1970 28 p refs
(CERN-70-20) Avail: AEC Depository Libraries

A pulsed power supply for feeding septum magnets of the CERN proton synchrotron is described. The various aspects for realization during the design stage are shown and their influence on the performance of the supply is discussed. Author (NSA)

N71-13701# Advisory Group for Aerospace Research and Development, Paris (France).
ELECTROMAGNETICS OF THE SEA Conference Proceedings
Nov. 1970 643 p refs Mostly in ENGLISH; partly in FRENCH
Meeting of AGARD Electromagnetic Wave Propagation Panel Specialists held in Paris, 22 – 26 Jun. 1970
(AGARD-CP-77-70) Avail: NTIS

Electromagnetic wave applications in at-sea environments are discussed. The importance of underwater electromagnetic wave propagation for communication and optical imaging purposes is emphasized. For individual titles, see N71-13702 through N71-13741.

N71-13728# Texas Univ., Austin. Antennas and Propagation Lab.
MONTE CARLO CALCULATION OF LIGHT TRANSMISSION THROUGH WATER

Kenneth R. Hessel and Alfred H. LaGrone *In* AGARD Electromagnetics of the Sea Nov. 1970 6 p refs (See N71-13701 04-23)
Avail: NTIS

The transmission characteristics of laser light through water have been determined using a Monte Carlo method of photon tracing to predict the irradiance distribution on a plane perpendicular to the main beam of light at any distance from the source. Anisotropic scattering of the photon by the scattering particles was assumed. The calculations required a knowledge of the mean absorption length, the mean scattering length, and the scattering probability for the water. Calculations were made for two water samples at two distances for each sample and are reported. Laboratory measurements show excellent agreement with the computed values. Author

N71-13727# Plessey Co., Ltd., Havant (England). Electronics Research Lab.
THE ATTENUATION OF COLLIMATED LIGHT BY SEA WATER
D. G. Keith-Walker *In* AGARD Electromagnetics of the Sea Nov. 1970 12 p refs (See N71-13701 04-23)
Avail: NTIS

Determined is the attenuation of a collimated light beam propagting in seawater. The factors which affect the attenuation of light are discussed; these are absorption scattering, wavelength and beam divergence. The necessity to carry out a series of measurements on the attenuation and scattering properties of water arises out of the consideration of these factors. The design and construction of the equipment necessary to make highly accurate measurements of the attenuation of a collimated beam in situ in seawater is presented and followed by details of the measurement program. This program was designed to obtain the attenuation profiles down to depths of approximately 300 meters for a range of seawater turbidities and other conditions. Author

N71-13728# Paris Univ. (France). Lab. d'Oceanographie Physique.
EVALUATION OF EXPERIMENTAL RESULTS ON LIGHT SCATTERING BY SEA WATER [EXAMEN DE RESULTATS EXPERIMENTAUX CONCERNANT LA DIFFUSION DE LA LUMIERE PAR LES EAUX DE MER]
Andre Morel *In* AGARD Electromagnetics of the Sea Nov. 1970 11 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)
Avail: NTIS

The degradation of light energy in seawater can be directly investigated by submerging photometers and measuring the submarine remainder of daylight at various depths. Absorption and scattering are dependent on wavelength. The various studies dealing with absorption coefficient variations in the visible and near ultraviolet range will be reviewed, discriminating between what is ascribable to water, mineral ions, and organic substances in solution in seawater. In natural seawater, scattering predominates over absorption (except in the infrared range). The spectral dependence of molecular scattering has been experimentally established. The direct study of scattering selectivity by particles is delicate, as it involves extremely accurate measurements as far as absolute values are concerned; one of the indirect methods developed consists in studying selectivity for a given scattering angle, and checking whether the shape of the scattering indicator varies with wavelength. The results obtained can be confirmed, at least in the case of sufficiently turbid water, by effecting attenuation measurements in the same spectrum range, and deducting absorption. Author

N71-13729# Paris Univ. (France). Lab. d'Oceanographie Physique.
STUDY ON LIGHT SCATTERING BY SEA WATER. SMALL ANGLE MEASUREMENTS BY MEANS OF CONVENTIONAL AND LASER SOURCES [ETUDE DE LA DIFFUSION DE LA LUMIERE PAR L'EAU DE MER. MESURES AUX PETITS ANGLES A L'AIDE DE SOURCES CLASSIQUES ET DE SOURCES LASERS]
Francois Nyffeler *In* AGARD Electromagnetics of the Sea Nov. 1970 10 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)
Avail: NTIS

Light scattering in seawater near the propagation direction of a light beam has been studied by means of conventional and laser sources. Measurements were carried out at various wavelengths. Angular scattering coefficients were not measured in absolute values; nevertheless, it was possible to compare the shapes of the scattering indicators obtained at various wavelengths over the angular area considered. A comparison of the various series of measurements shows that the seawater scattering indicator shape, for small angles, is practically independent of the light wavelength used; it does not depend either on light coherence. The indicators obtained correlate well with those presented by other researchers. Therefore, instruments designed for measuring seawater scattering properties could be equipped with laser sources in so far as such sources improve their performance. Author

N71-13730# Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
OBSERVATION OF LIGHT SCATTERING IN DIFFERENT WATER MASSES
G. Kullenberg *In* AGARD Electromagnetics of the Sea Nov. 1970 10 p refs (See N71-13701 04-23)
Avail: NTIS

In situ measurements of light scatter in the Sargasso Sea and in the Baltic are compared. The total scattering functions are similar in shape, with pronounced forward scatter. In the Sargasso Sea the molecular scatter has a significant influence which is not the case in the Baltic, proving the Sargasso Sea to be extremely poor in particles. The particle scatter is between one and two orders of magnitude stronger in the Baltic. The intense small angle scatter there is probably caused by large, transparent particles of biological origin. In the Sargasso Sea the particle scatter is virtually independent of wavelength, while in the Baltic it is strongest in the green part of the spectrum. An attempt is made to determine discrete particle size distributions by using the observed scattering functions and calculations by means of the Mie theory. For the Sargasso Sea the distribution conforms nicely with observations; for the Baltic no definite result can be given at present. Author

N71-13731# Paris Univ. (France). Lab. d'Oceanographie Physique.
DAYLIGHT PENETRATION OF THE SEA [PENETRATION DE LA LUMIERE DU JOUR DANS LA MER]
L. Prieur *In* AGARD Electromagnetics of the Sea Nov. 1970 9 p refs In FRENCH; ENGLISH summary (See N71-13701 04-23)
Avail: NTIS

The properties of daylight after it has propagated through seawater over various distances undergo considerable modifications due to the interaction of the electromagnetic waves with the medium. The two optical characteristics of seawater which essentially describe such interaction are selective absorption and scattering. As a result, the spectrum and space distributions of daylight are modified. An attempt is made to demonstrate that partial, however valuable knowledge of the above mentioned phenomena, can be achieved by means of simple instruments. With this purpose in view, first the relationship with the spectrum properties of the measurements already carried out with instruments specifically designed for investigating daylight penetration, is discussed. Then,

in connection with space properties, the boundary distribution of luminances and its prediction based on the optical properties of seawater will be considered. Author

N71-13733# Tetra Tech, Inc., Pasadena, Calif.
LOSS OF OPTICAL RESOLUTION IN SEA WATER BY MULTIPLE SMALL-ANGLE SCATTERING
Willard H. Wells and Marion N. Todd *In* AGARD Electromagnetics of the Sea Nov. 1970 12 p refs (See N71-13701 04-23)
Avail: NTIS

Multiple scattering of light by particles suspended in liquid can be a cause of degraded optical resolution. This is especially significant when the particles are relatively large and numerous, but most of the scattered power is deflected through very small angles owing to a near match between the refractive indices of the particles and the medium. Formulas which convert the volume scattering function to an image modulation transfer function have been derived and interpreted for this case. This conversion allows one to calculate image degradation given the scattering properties of the medium. The conversion from scattering function to optical transfer function is evaluated for one published scattering function measured in sea water. Graphs of image degradation and beam decollimation are given. The inverse transform is also derived so that one can calculate the scattering properties given the loss of resolution. The latter is best measured by imaging a set of paralled bar patterns having a wide range of spatial frequencies. A scattering meter based on this inverse transform was built and tested. Author

N71-13734# Stanford Research Inst., Menlo Park, Calif.
THE THEORY OF LIGHT SCATTERING IN THE SEA
Frank Chilton, W. K. Talley (Calif. Univ., Davis), and D. D. Jones (Calif. Univ., Davis) *In* AGARD Electromagnetics of the Sea Nov. 1970 10 p refs Prepared jointly with Calif. Univ., Davis (See N71-13701 04-23)
Avail: NTIS

Light is scattered in the underwater environment by particles and turbulence. This scattering causes a background radiance at the detector and a substantial loss of resolution over any distance. Absorption strongly attenuates the radiance at a distance. Developed is a general potentially complete, model of underwater visibility based on a semianalytic Monte Carlo computation using phenomenological volume scattering functions. A theoretically based parametrization of the volume scattering function provides a shape fit by only two parameters, but capable of describing both turbulence and particles. The behavior of resolution for different parameter values was studied systematically. A general law or scaling rule for resolution was found. Author

N71-13735# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
TRANSPORT ANALYSIS OF OPTICAL PROPAGATION IN THE UNDERSEA ENVIRONMENT
David L. Feinstein, Kenneth R. Piech, and A. Leonard (Stanford Univ.) *In* AGARD Electromagnetics of the Sea Nov. 1970 11 p refs Prepared jointly with Stanford Univ. (See N71-13701 04-23)
Avail: NTIS

Investigated is the application of the singular eigenfunction expansion technique to the solution of the underwater radiative transport problem. The scalar transport equation is solved by the singular eigenfunction expansion technique for a plane wave incident on a homogeneous half space characterized by a highly anisotropic scattering distribution. An experimental seawater volume scattering function is treated by a high order expansion in Legendre polynomials. Results for reflected radiance are presented for a 9th order polynomial fit, with undersea radiance distribution given to a 8th order fit. The preliminary results agree qualitatively with experimental measurements of underwater radiance distributions. Author

N71-13736# Stanford Research Inst., Menlo Park, Calif.
OPTICAL ABSORPTION AND TURBULENCE-INDUCED NARROW-ANGLE FORWARD SCATTER IN THE SEA
Richard C. Honey and Glenn P. Sorenson *In* AGARD Electromagnetics of the Sea Nov. 1970 9 p refs (See N71-13701 04-23)
Avail: NTIS

One of the most fundamentally limiting optical parameters of sea water is the volume absorption coefficient. In typical oceanic waters in which the absorption and scattering coefficients are roughly the same, it has not been a simple matter to measure the attenuation coefficient independent of scattering. A new instrument has been developed to do just this. Basically, it consists of a point source of light and an irradiance detector at a known distance from the point source. Another parameter in addition to absorption and particulate scattering that can limit the performance of underwater imaging systems is due to fluctuations in index-of-refraction, or optical turbulence. Such fluctuations, resulting from fluctuations in temperature or salinity, occur in the ocean due to a variety of natural causes. Several techniques have been employed to demonstrate the phenomena. Author

N71-13737# Oregon State Univ., Corvallis. Dept. of Oceanography.
IMAGE DEGRADATION OVER SEAWATER PATHS A Review
J. R. Zaneveld, R. Hodgson, and G. F. Beardsley, Jr. *In* AGARD Electromagnetics of the Sea Nov. 1970 10 p refs (See N71-13701 04-23)
Avail: NTIS

Reviewed is the introduction of communication theory into hydrological optics; compared are various experimental and theoretical results that have appeared in the literature. Particular attention is given to three recent papers dealing with the theoretical prediction of the modulation transfer function of seawater. These three papers utilize analytic, numerical, and Monte Carlo techniques. The methods, limitations, and results of each paper are compared and the applicability of each approach to typical submarine viewing situations is discussed. Author

N71-13738# Naval Photographic Center, Washington, D.C.
UNDERWATER OPTICS
V. A. Seifert *In* AGARD Electromagnetics of the Sea Nov. 1970 14 p refs (See N71-13701 04-23)
Avail: NTIS

Underwater optical studies and the development of a number of concentric dome lenses for 16 mm motion picture, 35 mm and 70 mm format still picture cameras are discussed. This report describes validation tests of these developments. Tests were run on an underwater calibrator and compared with the plane parallel window with an air lens and the corrector approach. Design criteria are discussed for lens selection depending on the particular application. Test results indicate that lenses designed specifically for underwater photography outperform air lenses adapted for underwater imaging. Resolution and distortion for water lenses was superior for wide angle coverage. The corrector and concentric dome approach resulted in similar results. The concentric dome has better structural strength than any plane parallel window or corrector. Author

N71-13739# California Univ., La Jolla. Visibility Lab.
PROGRAM OF RESEARCH IN OPTICAL OCEANOGRAPHY AT SCRIPPS INSTITUTION OF OCEANOGRAPHY
J. E. Tyler *In* AGARD Electromagnetics of the Sea Nov. 1970 23 p (See N71-13701 04-23)

Avail: NTIS

The measurement concepts that have been developed by theory for the purpose of describing the penetration of radiant energy into the ocean are discussed briefly, and new instrumentation which has been developed for the measurement of these concepts in the ocean is described. Some of the specific measurements discussed are the measurement of scattering by particles in the ocean, the measurement of the beam transmittance of a unit path length, and the important measurement of radiance distribution around a fixed point underwater. In the case of radiance distribution, the optical properties that can be derived from this measurement are also be outlined and instrumentation for the independent measurement of some of these derived properties are discussed. Author

N71-13740# Centro Informazioni Studi Esperienze, Milan (Italy).
EVALUATION OF UNDERWATER VISIBILITY IMPROVEMENT BY RANGE GATING SYSTEMS
S. Donati and A. Sona *In* AGARD Electromagnetics of the Sea Nov. 1970 11 p refs (See N71-13701 04-23)
(Contract CNR-CISE-17.8.3.1)
Avail: NTIS

The underwater propagation problem, including the time dependence, has been studied by means of the Monte Carlo method with the aim of evaluating the visibility improvement achievable with range gating techniques. Results are presented for various cases of observation, taking into account powers required from light sources. The different modes of operation are compared and expected performance discussed. Author

N71-13741# Tetra Tech, Inc., Pasadena, Calif.
SYNCHRONOUS SCANNING
H. Hodara and W. H. Wells *In* AGARD Electromagnetics of the Sea Nov. 1970 15 p refs (See N71-13701 04-23)
Avail: NTIS

In comparing synchronous scanning with conventional illumination it is shown that the same field of view is covered by the broad beam instantaneously and by the narrow beam during the scanning time. However, the total backscattering volume is much smaller with the narrow scanning. The total backscatter for the static flood beam illumination is the large triangle bounded by the heavy lines. The backscatter for each position of the narrow beam during the synchronous scan is the small cross-hatched triangle. The total area (volume in space) enclosed by the cross-hatched triangle is much smaller than that of the large triangle. Author

N71-13943# Notre Dame Univ., Ind. Coll. of Engineering.
THE MAGNETOSTRICTION OF MAGNETIC COMPOSITE MATERIALS
C. W. Allen and W. H. Kao Aug. 1970 38 p refs
(Contract N00014-68-A-0152)
(AD-712523; THEMIS-UND-70-11) Avail: NTIS CSCL 20/3

A simple theory for the magnetostriction of laminate and particulate magnet composites is presented and the magnetic, mechanical and magnetomechanical complications of such materials are discussed. The results of experiments on several particulate composites based on cobalt ferrite with silver, copper and nickel matrices are presented and compared with their theoretical expectations. Author (TAB)

N71-13959# Kansas Univ., Lawrence. Dept. of Physics.
[DYNAMIC ASPECTS OF CONCENTRATED MAGNETIC SYSTEMS] Final Report
Peter M. Richards Jun. 1970 12 p refs
(Contract AT(11-1)-1488)
(COO-1488-21) Avail: NTIS

Experimental and theoretical results are given for various magnetic systems. Emphasis is placed on spin wave excitation, observations of their lifetime through novel pulse techniques, and excitation measurement. E.H.W.

N71-14073# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
A SEQUENCE OF TRANSIENT ACOUSTICAL SOURCES IN AN IDEALIZED JET
E. W. Graham Sep. 1970 21 p refs
(DI-82-1002) Avail: NTIS

A sequence of transient acoustical point sources is considered as a noise generator in an idealized two-dimensional jet. Each transient source starts at the same position relative to the stationary nozzle (or external air), drifts downstream with the local fluid for a given time, then disappears. As each source disappears a new one appears at the initial position. The far field mean-square pressures are obtained from a previous analysis of the effects of permanent sources, and are converted from a coordinate system fixed in the source to retarded coordinates fixed in the external air (or stationary nozzle). In the examples, two jet velocity profiles are studied, first a jet composed of linear velocity profile shear layers meeting at the center, and second a uniform jet bounded by velocity discontinuities. As found previously for the permanent source, large differences in far field mean-square pressures appear for these two jet velocity profiles. However, the greatest magnitudes of mean-square pressure are now rotated into the downstream field. Author

N71-14081*# Kaman Nuclear, Colorado Springs, Colo.
SOUND PROPAGATION FROM A MOVING SOURCE Final Report
C. Eugene Buell 24 Nov. 1970 104 p
(Contract NAS8-11348)
(NASA-CR-102945; KN-70-698-(FR)) Avail: NTIS CSCL 20A

The development of a computer program for estimation of sound intensity from a rising space vehicle is reported. The material presented includes: (1) a summary of the ray tracing methods used and the modifications that are required to apply the technique to the case of a moving source; (2) a discussion of the inputs to the program; (3) program flow charts; (4) input and output data for several sample runs; and (5) program listing and subroutines. Author

N71-14085# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
ESTIMATES FOR THE FIELD ERRORS FROM COIL WINDING IRREGULARITIES IN SUPERCONDUCTING MAGNETS
T. C. Randle Jun. 1970 12 p refs
(RHEL/R-197) Avail: AEC Depository Libraries; UK 1s9d

The magnetic field errors arising from the irregularities in conductor positioning of an air cored magnet are estimated statistically. The effects on the harmonic field coefficients for bending and quadrupole magnets are included. Author (NSA)

N71-14093# Stanford Linear Accelerator Center, Calif.
DETERMINATION OF THE MAXIMUM (PEAK) ELECTRIC FIELD IN DISK-LOADED WAVE-GUIDES IN THE E SUB 01 MODE [OPREDELENIE MAKSIMALNOGO ELEKTRICHESKOGO POLYA V DIAFRAGMIROVANNYKH VOLNOVODAKH NA VOLNE E SUB 01]
A. I. Zykov et al [1970] 15 p refs Transl. into ENGLISH of Akad. Nauk Ukr. SSR, Kharkov, report KHFTI-69-23
(SLAC-Trans-116; KHFTI-69-23) Avail: NTIS

The method of small perturbations has been used to measure the ratio of the maximum electric field to the accelerating field in disk-loaded traveling-wave waveguides, and also the values of R/Q in the range of a/b = 0.25 − 0.40, for modes Psi = Pi/2, 2Pi/3, 3Pi/4; with lambda sub 0 = 10.71 cm, and disk thickness t = 4 mm. Author (NSA)

N71-14102# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
TEMPERATURE STABILISED MAGNETO-RESISTOR FOR 0.1% MAGNETIC FIELD MEASUREMENT
P. R. Mace and E. Welch Aug. 1970 20 p refs
(RHEL/R-192) Avail: AEC Depository Libraries; UK 4s6d

The development of a low cost, simple flux monitor of repeatable accuracy of better than 0.1% for use in high energy nuclear physics experiments on Nimrod is described. The system is intended ultimately to control the current stabilized rectifiers and so provide a stable field control. The present day alternative methods of field measurement are compared. Author (NSA)

N71-14103# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
DEVELOPMENT AND CONSTRUCTION OF MAGNETIC SYSTEMS FOR THE 'URAGAN' STELLARATOR AND STUDIES OF MAGNETIC SURFACES OF LARGE 'LATITUDE'
V. F. Aleksin et al Sep. 1970 50 p refs Transl. into ENGLISH of Akad. Nauk Ukr. SSR, Kharkov, report KHFTI-69-39
(AEC-tr-7258; KHFTI-69-39) Avail: NTIS

Magnetic surfaces in toroidal stellarators described in the literature are discussed. An attempt was made of selecting magnetic system parameters for the racetrack stellarator Uragan in order to obtain large latitude magnetic surfaces. Design and specificatimns of the stellerator windings as well as the entire magnetic system are discussed. NSA

N71-14188# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
PHASE MATCHED CRITICAL TOTAL REFLECTION AND THE GOOS-HAENCHEN SHIFT IN SECOND HARMONIC GENERATION
H. Shih and N. Bloembergen Jul. 1970 37 p refs
(Contract N00014-67-A-0298-0006)
(AD-710772; TR-614) Avail: NTIS CSCL 20/6

It is well established that a totally reflected light beam of finite diameter undergoes a lateral displacement, known as the Goos-Haenchen shift. The theory for the corresponding effect in nonlinear optics is presented. The special phase-matched case, in which both the fundamental and second harmonic are at critical total reflection, is shown to have a characteristic radiation pattern. Since the finite beam diameter is taken into account, divergencies of earlier theories are eliminated. Author (TAB)

N71-14207# Sandia Corp., Albuquerque, N.Mex.
USE OF OPTICAL TRANSFORMS FOR ANALYSIS OF ACOUSTIC AND SEISMIC DATA
R. G. Scherrer Apr. 1970 20 p refs
(SC-DR-70-206) Avail: NTIS

A technique is described which uses optical transforms to obtain the spectral analysis of acoustic and seismic data. The basic technique is to modulate the intensity of a cathode ray tube beam with the electrical analog signal and photograph the result on moving photographic strip film. When the resulting mask is introduced into the aperture of a system of lenses and collimated light, the Fourier transform of the aperture distribution is obtained as a result of Fraunhofer diffraction from the grating effect of the mask. Since the data are in a continuous form on the strip film, movement of the strip film along its time axis results in a time-resolved spectral analysis. An analogy is drawn between the optical and the numerical method of obtaining transforms, and some of the limitations and restrictions of techniques are analyzed. Author

N71-14213# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
BEHAVIOR OF NOZZLES AND ACOUSTIC LINERS IN THREE-DIMENSIONAL ACOUSTIC FIELDS Quarterly Report, 1 Jun. – 31 Aug. 1970
Ben T. Zinn, Allan J. Smith, Jr., and B. Robert Daniel 31 Aug. 1970 6 p
(Grant NGL-11-002-085)
(NASA-CR-102838) Avail: NTIS CSCL 20A

The computer program that uses experimental data to determine the nozzle admittances was updated in order to (1) eliminate a double-root solution and (2) to statistically curve-fit the resultant admittance data. Prior to actual nozzle testing preliminary tests were conducted in order to determine (1) the effectiveness of the installed muffler, (2) the best mode of chamber frequency excitation, (3) the chamber acoustics under flow and no-flow conditions, and (4) the quality of the data measured by various transducers located at different locations along the chamber. Author

N71-14229 Illinois Univ., Urbana.
ELECTROHYDRODYNAMIC SECONDARY FLOW
Omar Elhadi Ramadan (Ph.D. Thesis) Ann Arbor, Mich. Univ. Microfilms 1969 351 p refs
(Grant PHS-1R01-AP-00641-01)
Avail: Univ. Microfilms $16.00

The electrostatically-induced secondary flow of gases carrying particles which is generated in a system of plates and wire precipitators is investigated. The basic relations governing the fluid and the particles using the continuum concept are examined, and solutions are presented for the electric Reynolds number. It is concluded that the secondary flow circulates in loops in the space between neighboring wires and the conducting wall. This circulation sweeps particles back in the flow so that the collecting efficiency is reduced. F.O.S.

N71-14234# Joint Inst. for Nuclear Research, Dubna (USSR).
ON CALCULATION OF FIELDS, INPUT IMPEDANCE, CURRENTS, AND TENSION IN THE LINEAR INDUCTION ACCELERATOR INDUCTORS
P. V. Bukaev and V. P. Sarantsev 1970 23 p refs In RUSSIAN
(JINR-P9-5129) Avail: AEC Depository Libraries

The calculation of the electrial and magnetic fields, elements of the equivalent conversion circuit, and input impedance of the inductors and sections, which is based on the substitutions of distributed parameters by lumped ones, is presented. Transfer and frequency characteristics of the inductor and section are determined. The chain of a high-current impulse circuit with nonuniform forming line and stray induction is considered. Final expressions for tensions and currents in the exciting and secondary windings of inductor are obtained. The pictures and calculation curves of tension and current in a primary inducter winding are presented. Author (NSA)

N71-14291# Northeastern Univ., Boston, Mass. Dept. of Physics.
THE LOW TEMPERATURE PROPERTIES OF THE ANDERSON MODEL OF LOCALIZED MAGNETIC MOMENTS
L. Dworin Nov. 1970 81 p refs
(NUB-2031) Avail: NTIS

The low temperature (T < T sub c) behavior of the physical properties of the nondegenerate Anderson model is obtained by a

method similar to Migdal's approach to the critical behavior of a Bose fluid. It is shown how lambda, the coupling constant for the interaction of the low energy transverse spin fluctuations with the extra-orbital electron is of order unity for T → 0. The contribution to the thermodynamic potential and magnetic susceptibility from the high energy region (omega > T sub o) is considered to enter only as a renormalization of the constants in the expression for the low energy contribution, which is obtained exactly in terms of certain definite integrals which, for lambda of order unity are also of order unity. In this matter dimensional constraints for the physical properties are obtained (i.e., scaling laws). Concrete expressions for a wide variety of physical properties are obtained. Author

N71-14296# Physics Lab. RVO-TNO, The Hague (Netherlands).
TECHNIQUE FOR THE MEASUREMENT OF THE PERMITTIVITY OF SOLIDS, LIQUIDS AND PASTES BETWEEN .1 AND 100 MHz [MEETTECHNIEK VOOR DE BEPALING VAN DE DIELEKTRISCHE CONSTANTE VAN VASTE STOFFEN, VLOEISTOFFEN EN PASTA'S TUSSEN .1 EN 100 MHZ]
B. Hoekstra Apr. 1970 43 p refs In DUTCH; ENGLISH summary
(PHL-1970-10) Avail: NTIS

A measuring cell consisting of a condenser with two parallel flat circular plates is described. It is designed for determining the dielectric properties of frozen heterogeneous systems containing water and of pastes (e.g. soils, biologic materials, etc.). The cell can be used to 100 MHz and the temperature range covered is from −60 deg to +30 C. Different materials were used for the calibration and testing of the system. Author

N71-14304*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
QUADRUPOLE SEGMENTED ROD STUDY
Oct. 1970 57 p
(Contract NAS5-11185)
(NASA-CR-115776; SPO-30001) Avail: NTIS CSCL 20H

The introduction of ions into a quadrupole mass filter system under normal conditions inherently produces effects which are detrimental to the probability of a stable ion traversing the length of the quadrupole without striking the rods. The use of segmented rods to reduce the effects of the fringe fields and the instabilities of the scan line is considered. A theoretical analysis indicates that correct manipulation of the fringe fields could be very beneficial in the operation of a quadrupole mass spectrometer. This manipulation can take the form of an ac delayed dc ramp as in the segmented rod approach, or an ac plus dc ramp as in the quadrupole biasing approach. Segmented rod geometry appears to give higher intensity for a given set of conditions, but quadrupole bias has an edge on length and weight conditions. D.L.G.

N71-14305# Joint Publications Research Service, Washington, D.C.
METHODS FOR MEASURING FREQUENCY DEVIATIONS IN THE SECAM SYSTEM
Yu. V. Aksentov et al 4 Dec. 1970 12 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 8, 1970, p 44–48
(JPRS-51918) Avail: NTIS

The magnitude of the frequency deviation in the SECAM system is studied as one of the parameters determining the quality of the reproduced color image. The best method for measuring the frequency deviation is considered to be with a frequency detector and an oscillograph as an indicator. The electronic switching is described, and circuitry diagrams are presented. It is concluded that the measurement error by this method is plus or minus one kHz. F.O.S.

N71-14308# Oslo Univ. (Norway). Inst. of Physics.
FLUORESCENCE-POLARIZATION FUNCTIONS
Erik Leif Eriksen and Aadne Ore [1970] 14 p refs
Avail: NTIS

The unified treatment of self-depolarization of fluorescence as proposed by Knox is compared to the earlier treatment by Weber, who employs polarization functions in which the one that pertains to the case of excitation with unpolarized light differs from that employed by Knox. The discrepancy observed to exist between the corresponding addition relations is shown to be a question of definitions. Author

N71-14307*# National Aeronautics and Space Administration, Washington, D.C.
ACOUSTICS TECHNOLOGY A Survey
Skipwith W. Athey 1970 138 p refs
(NASA-SP-5093) Avail: SOD $0.65; NTIS CSCL 20A

This survey reflects the continuing contributions of NASA in the problems of sound and acoustics, particularly those involving noise reduction. As an atmospheric pollutant, the effects and damages of noise are treated from structural damage to aircraft and spacecraft to the physical and psychological disturbance and annoyance incident to the noise generated. Special technical contributions include determining what mechanism generates the noise from high-speed gas jets, and the study of noise propagated by spacecraft boosters in the atmosphere. Predicting the conditions under which anomalous propagation will occur will permit launching or tests to be scheduled when the atmospheric conditions are favorable. Another area of concentration is investigating the origin of the compressor noise generated in a turbojet aircraft engine. The greatest long-range nonaerospace value, however, has been determining and evaluating the actual subjective effects of noise on human beings. The development of a more valid measurement of the subjective effects of noise has proved the most useful tool in this direction. E.M.C.

N71-14335# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
ROLE OF PHOTO-ELECTRONS IN OPTICAL DAMAGE
R. W. Hellwarth *In* NBS Damage in Laser Mater. Dec. 1970 p 67–75 refs Sponsored in part by ARPA Prepared in cooperation with Hughes Res. Labs. (See N71-14326 04-16)
(Grant AF-AFOSR-1622-69)
Avail: SOD $1.25

Discussed are processes by which conduction electrons damage a crystal lattice even before they gain enough energy to ionize their surroundings. Considered are sapphire and ruby crystals. It is shown that the energy that the conduction electrons absorb linearly from the optical beam is deposited almost immediately in the lattice without significant heating of the electrons. At electron densities and optical intensities likely to exist at sapphire damage thresholds, this deposited energy is found to be of the order required to form a rupturing shock wave. It is also shown that the photo-excitation of both bound and unbound impurity levels is enhanced by the presence of conduction electrons, so markedly so for the former that the promotion of electrons into the conduction band may be significantly bootstrapped, thereby increasing the optical absorption. The presence of conduction electrons and excited impurities in numbers is likely to alter the refractive index significantly and affect the focusing of the beam. Author

N71-14389# University of Southern Calif., Los Angeles. Dept. of Chemistry.
THEORETICAL INTERPRETATION OF THE OPTICAL AND ELECTRON SCATTERING SPECTRA OF H2O
C. R. Claydon, G. A. Segal, and H. S. Taylor [1970] 25 p refs Sponsored in part by Alfred P. Sloan Found., Am. Chem. Soc., and

the Res. Corp.
(Grant NSF GP-2861)
Avail: Issuing Activity

Energies and potential surface characteristics are assigned to the first eight excited states of the water molecule. This assignment is shown to be consistent with all data from optical spectra, electron scattering, rotational distributions of the OH fragment in photo-dissociation and associated data, and with semi-empirical INDO calculations. Energies and potential surfaces are given for the lowest resonant states of H2O(−). These are consistent within explainable error with INDO calculations as well as with the data on dissociative attachment and associative detachment in which H2O(−) is an intermediate for species. Assignment-confirming experiments are suggested. Author

N71-14418# Chicago Univ., Ill. James Franck Inst.
EXPERIMENTAL INVESTIGATIONS ON THE PROPERTIES OF MATTER AT LOW TEMPERATURE Final Technical Report, 1 Apr. 1968–30 Jun. 1970
Lothar Meyer 30 Jun. 1970 8 p
(Grant NSF GP-8375)
Avail: Issuing Activity

Experimental investigations on the properties of matter at low temperatures are reported. Subjects discussed are: (1) van der Waals' lattices, (2) quantum hydrodynamics at temperatures below 0.1 degrees Kelvin, (3) scattering of X-rays from liquid helium isotopes, and (4) mobility of electrons in liquid argon. P.N.F.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-13473# Academy of Sciences (USSR), Moscow.
ANALYSIS OF EXPERIMENTS IN THE MEASUREMENT OF NEUTRON FLIGHT TIME
A. P. Petrov, Yu. Petrykin, I. I. Svrina, and A. V. Khovanskii 1969 28 p refs In RUSSIAN
(IAE-1908) Avail: AEC Depository Libraries

This report is a brief analysis of the errors arising in a device for the measurement of neutron flight time. The purpose of the study is to investigate the possibilities for increasing the effectiveness (transmission) of the device through complicating the method of modulating the neutron flux from the source, and through additional processing of measurement data. Author (NSA)

N71-13547# California Univ., Livermore. Lawrence Radiation Lab.
MIRROR MACHINES AND DIRECT CONVERSION
R. W. Werner 26 May 1970 37 p refs Presented at Symp. on Fission Reactor Design, Lubbock, Tex., 2-5 Jun. 1970 Submitted for publication Sponsored by AEC
(UCRL-72587; Conf-700614-2) Avail: NTIS

Direct conversion of fusion-reactor charged-particle energy to electrical form is discussed. The method of conversion, using a series of electrostatically focused collector electrodes, permits efficiencies in excess of 90%. The sources of charged particles are the "classical losses" in mirror machines, i.e., the loss of charged particles into the escape cone of the mirrors. Author (NSA)

N71-13548# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
NONDISPERSIVE X-RAY SPECTROMETRY WITH Si(Li) and Ge(Li) DETECTORS [SPECTROMETRIE X NON DISPERSIVE AVEC Si(Li) ET Ge (Li)]
Alain Friant 10 Jun. 1970 41 p refs In FRENCH Presented at the Ann. Meeting on Electron. Porbe Analysis, Lille, 2 Jun. 1970
(CEA-Conf-1541; Conf-700619-1) Avail: AEC Depository Libraries

Significant improvements on energy resolution of spectrometry units with narrow window Si(Li) and Ge(Li) detectors, open bright prospects for X or gamma photon spectrometry (energy greater than 1 keV). After a brief description of such an X-spectrometry chain, the principal parameters of the detectors are successively studied: resolution energy, detection threshold, efficiency, etc. The technology of high performance Si(Li) and Ge(Li) detectors designed in the laboratory as well as performances expected of them in the near future (100 eV to 6 keV) will lead to a number of applications including nondestructive and rapid analysis by X-fluorence association with electronic microprobes. NSA

N71-13550# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
SPECTRAL MEASUREMENTS ON RADIOACTIVE NEUTRON SOURCES IN THE ENERGY RANGE OF 10 keV TO 10 MeV WITH PROTON RECOIL PROPORTIONAL COUNTERS [SPEKTRUMSMESSUNGEN RADIOAKTIVER NEUTRONENQUELLEN IM ENERGIEBEREICH VON 10 keV BIS 10 MeV MIT PROTONENRUECKSTOSS-PROPORTIONALZAEHLROHREN]
H. Werle Feb. 1970 107 p refs In GERMAN; ENGLISH summary
(NP-18359; INR-4/70-25) Avail: AEC Depository Libraries

Proton recoil proportional counters have been used for neutron spectrum measurements in the energy range between about 20 keV and 1.5 MeV. It is shown by measurements with monoenergetic neutrons and by comparison measurements with other methods, that with proton recoil counters, reliable measurements are also possible below 20 keV and in the energy range between 1.5 and 10 MeV. The spectra of most of the normally used, radioactive neutron sources (alpha,n-sources: Ra–Be, Am–Be, Am–B, Am–B-10, Am–F, Am–Li; Cf-252 spontaneous fission source) were measured in the whole interesting energy range, especially also in the range below 1 to 2 MeV. The influence of the size of the radioactive particles on the neutron spectrum was studied. The differential neutron spectrum of a Sb–Be (gamma,n)-source can be determined for the first time with good accuracy, in spite of the very high gamma background, by using the gamma-n discrimination technique. Author (NSA)

N71-13551# Comitato Nazionale per l'Energia Nucleare Frascati (Italy).
QED TESTS IN THE TIME-LIKE REGION
F. Felicetti 15 May 1970 30 p refs
(LNF-70/23; Rept-479) Avail: AEC Depository Libraries

Quantum electrodynamics tests in the time-like lepton region are considered. It is examined in what direction and to what extent a breakdown of the theory can occur consistent with established experimental and theoretical results. Also some experimental tests of quantum electrodynamics are discussed. NSA

N71-13552# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
ELECTRON-POSITRON ELASTIC SCATTERING AT HIGH ENERGIES
B. Bertoli, B. Cohuzzi, F. Felicetti, G. Goggi, and G. Marini 22 Jul. 1970 13 p refs Presented at 15th Intern. Conf. on High Energy

Phys., Kiev, Aug. 1970 *Its* Nota Interna 487
(LNF-70136) Avail: AEC Depository Libraries

The production of new spin charge parity neutral bosons was sought in e positive electron + e negative electron interactions at the Adone storage ring. The energy of the incident particles was fixed at values between 0.8 and 1.0 GeV. Comparing the observed wide-angle e positive electron e negative electron elastic scattering rate, a test of the validity of quantum electrodynamics is obtained with squared space-like momentum transfers to the virtual photon up to about 1.7 (GeV/c)squared. It is concluded that in the energy range explored the experimental data show a slope and an absolute value in agreement with the prediction of quantum electrodynamics to within the experimental error of about 10%. NSA

N71-13553# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
THE WORK OF THE RUTHERFORD LABORATORY, 1969
A. P. Banford and F. M. Telling, eds. May 1970 192 p refs
(RHEL/R-191) Avail: AEC Depository Libraries

Research and development efforts are reported for computers, bubble chamber and spark chamber radiation detectors, and other high energy instruments. Operational aspects of the Nimrod synchrotron are discussed; research in nuclear physics and for the linear accelerator is included. NSA

N71-13558# Academy of Sciences (USSR), Moscow.
METHOD FOR CALCULATING THE ENERGY SPECTRUM OF LOW-LYING STATES OF SPHERICAL NUCLEI
E. E. Sapershtein and V. A. Khodel 1969 72 p refs In RUSSIAN
(IAE-1855) Avail: AEC Depository Libraries

The calculation of the energy spectrum of low-lying states of spherical nuclei is considered. An equation was obtained which permits the expression of the amplitude of the paired interaction as an effective interaction potential. NSA

N71-13571# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
OBTAINING OF NUMERICAL RESULTS FROM A MASS SPECTROMETER
J. Rion 1970 11 p In FRENCH Presented at the 5th Intern. Meas. Confederation Conf., Versailles, France
(CEA-CONF-1542; CONF-700513-2) Avail: AEC Depository Libraries

Equipment developed for automatically treating mass spectrometer results is described. Author (NSA)

N71-13575# Sydney Univ. (Australia). School of Physics.
HYDROMAGNETIC WAVE PROPAGATION IN INHOMOGENEOUS MAGNETIC FIELDS
J. A. Lehane and F. J. Paoloni 1970 22 p refs
(NP-18419; ER-51) Avail: AEC Depository Libraries

Results are presented for torsional waves propagating into magnetic beaches and compressional waves into magnetic cliffs. The inhomogeneous field used consisted of two uniform fields of different magnitude connected by a transition region the length of which could be changed. Attention was concentrated on looking for a wave reflected from the field discontinuity. For torsional waves no reflected wave was detected either for waves of frequency much less than ion cyclotron frequency or for those which encountered ion cyclotron resonance in the low-field region. For compressional waves reflection was observed under some conditions. It was most pronounced when he length of the transition region was not appreciably greater than the wave attentuation length and when the wave was cut off in the high-field region. Values of the reflection coefficient and the phase change at reflection are given. Author (NSA)

N71-13599# University of Southern Calif. Los Angeles. Dept. of Chemistry.
MANY-BODY METHODS APPLIED TO ELECTRON SCATTERING FROM ATOMS AND MOLECULES. 2: INELASTIC PROCESSES
Gyorgy Csanak and Howard S. Taylor [1970] 24 p refs
Avail: NTIS

It is shown how the generalized random phase approximation, previously used to develop a self-consistent theory of elastic scattering and frequency dependent polarizability, can be extended to the calculation of inelastic scattering cross sections from the ground state of the target. It is also shown that simultaneously when calculating electron-atom scattering cross sections, one can calculate without much additional work elastic and some specific inelastic scattering cross sections for an electron scattering off a positive ion target. Improvements to the approximation scheme, using self-consistent perturbation methods, are briefly discussed. Author

N71-13600# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
ABSOLUTE EXPERIMENTAL CROSS SECTIONS FOR THE EXCITATION OF Ba(+) IONS BY ELECTRON IMPACT Technical Summary Report
M. O. Pace and J. W. Hooper 1 Sep. 1970 114 p refs
(Contract AT(40-1)-3027)
(ORO-3027-17) Avail: NTIS

The crossed-beam technique was used to measure absolute emission cross sections for the excitation of electric dipole transitions in the Ba(+) ion by electron impact at energies near and below threshold. The basic experimental method involves intersecting modulated ion and electron beams at right angles in a well-defined collision volume. A portion of the photon flux radiated from the collision volume by excited ions is detected by an optical system viewing the collision volume along the axis perpendicular to both beams. The total emission is calculated from the portion detected using the experimentally determined response of the detection system to isotropic radiation and a correction for anisotropy, obtained from the polarization of detected emission. The emission cross section is then calculated from the total emission, the two beam currents and their spatial distributions, and the energies. The cross sections measured are absolute in the strict sense that the optical detection system was calibrated with a light standard by a technique that takes into account all spatial and spectral variations. The only other experimental result available for comparison is in agreement well within the combined experimental uncertainty. Author (NSA)

N71-13603# United Kingdom Atomic Energy Authority, Harwell (England).
NEUTRON SPECTRUM MEASUREMENTS OVER A WIDE ENERGY RANGE USING A SINGLE SEMICONDUCTOR SPECTROMETER
M. G. Silk and S. B. Wright Jul. 1970 13 p refs
(AERE-R-6060) Avail: AEC Depository Libraries; HMSO 2s 6d; BIS $0.50

A single lithium 6 sandwich fast neutron spectrometer was used to study fast reactor neutron spectra over the energy range from 5 keV to 8 MeV over three decades. The results obtained were in good agreement with theoretical and other experimental studies of the same spectra, from which it may be concluded that the errors introduced by uncertainties in the cross section of lithium 6 are not more than 10%. Author (NSA)

N71-13804# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
USE OF TRANS-STILBENE CRYSTAL TO MEASURE THE EQUIVALENT DOSE IN A MIXED GAMMA-n FIELD
R. Bardina, M. Ladu, M. Pelliccioni and M. Roccella 6 Jul. 1970 12 p refs *Its* Nota Interna 483
(LNF-70/31) Avail: AEC Depository Libraries

Gamma-ray and neutron signals, separated by pulse shape discrimination, with a good equivalent dose response, were obtained. For the neutrons, a good equivalent dose response was obtained in the range of 0.1 to 10 MeV (where the elastic scattering is predominant) by suitable saturation of the pulses produced by recoil protons. For the gamma-rays, the absorbed dose was measured in the scintillator because of its tissue equivalence up to several MeV. In the range of gamma-ray exposure up to about 0.2 R/hr, the sum of the two measured contributions was constant, within the experimental errors, when the relative dose intensity was varied, keeping the total equivalent dose rate fixed. Author (NSA)

N71-13808# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
METHOD OF MEASUREMENT FOR EVALUATING THE TRANSPARENCY OF ENTRY WINDOWS OF Ge(Li) SEIMICONDUCTOR TO GAMMA AND X PHOTONS
Andre Pascal Jul. 1970 16 p In FRENCH
(CEA-N-1320) Avail: AEC Depository Libraries

A method is proposed for determining experimentally the transmission curve as a function of the energy of the entry window of Ge(Li) detectors using the ratio of the surfaces of two peaks in a gamma spectra produced by a simple emitter. The sources used do not have to be calibrated. The energy E phi/2 of the photon for which the transmission is 50% makes it possible to define the entire transmission curve. The energy range E phi/2 covered is from 10 to 70 keV, with 3 emitters: Co-57, Am-241, and Gd-153. Author (NSA)

N71-13813# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DIAGRAMS FOR RAPID CALCULATION OF GAMMA PROTECTIONS. ATTENUATION OF THE GAMMA RADIATIONS FROM FISSION PRODUCTS
Nicole Fourcade-Cancelle Feb. 1970 18 p In FRENCH
(CEA-N-1209) Avail: AEC Depository Libraries

These diagrams give the gamma dose rate (in Rad/hr at 1 meter) produced through different shielding materials by uranium irradiated during 500 days at 1 watt and cooled during periods of time from 1 to 365 days. The materials considered are lead, iron, ordinary and baryte concretes, glass, and lead glasses. These diagrams refer to thermal fission products of U-235 but could be used for another irradiated fuel or for fast neutron fission products. NSA

N71-13814# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CLASSIFICATION OF THE NUCLEI OF CA-40 BASED ON THE REACTIONS K-39(He-3,d GAMMA) CA-40 AND CA-40(p,p GAMMA)Ca-40
A. Tellez and R. Ballini [1969] 3 p Presented at the Intern. Conf. on Properties of Nucl. States, Montreal
(CEA-CONF-1335; CONF-690804-14) Avail: AEC Depository Libraries

From a study of the K-39(He-3,d gamma)Ca-40 and Ca-40(p,p' gamma)Ca-40 reactions at incident energies of 18 and 12 MeV respectively it was possible to classify the majority of the levels of Ca-40 into four groups. The first group consists of levels of negative parity, strongly excited by (3He,d), and which are deexcited toward levels of the same group. In the second group are levels excited by (p,p') and not by 3He and which are deexcited exclusively toward levels of the same group. The third consists of levels of negative parity, weakly excited by (3He,d), and which are deexcited partially toward levels of the second group. In the fourth group are levels excited by (p,p') and not by 3He and which are deexcited principally toward levels of the first group. NSA

N71-13815# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
MEASUREMENTS ON AN AMPLIFIER FOR NUCLEAR SPECTROMETRY WITH BIPOLAR SYMMETRIC RESPONSE INDEX [MESURES SUR UN AMPLIFICATEUR POUR SPECTROMETRIE NUCLEAIRE DONT LA REPONSE INDICIELLE EST BIPOLAIRE SYMETRIQUE]
Andre Petin and Gerard De Rosny Mar. 1970 45 p refs In FRENCH
(CEA-N-1298) Avail: AEC Depository Libraries

Measurements of nuclear pulse amplifier characteristics are described. The pulse shaping network yields a bipolar output pulse having nearly equal amplitude positive and negative peaks. The network was designed by J. L. Blankenship and C. H. Nowlin. The measurements are chiefly related to linearity, overload, signal-to-noise ratio, and thermal stability features. NSA

N71-13816# Interuniversitair Reactor Instituut, Delft (Netherlands).
THE USE OF AN X-RAY DETECTOR IN ACTIVATION ANALYSIS
M. de Bruin and P. J. M. Korthoven [1970] 8 p ref Presented at the Symp. on Semiconductor Detectors for Nucl. Radiation, Munich
(IRI-133-70-1; CONF-700827-1) Avail: AEC Depository Libraries

The possibilities and usefulness of using X-ray detectors in activation analysis of medium weight and heavy elements are discussed. Results are presented for the determination of palladium in platinum. NSA

N71-13817# Institute of Nuclear Research, Warsaw (Poland).
INVESTIGATION OF THE (n, ALPHA) REACTIONS INDUCED BY 14.2 MeV NEUTRONS IN ERBIUM ISOTOPES
M. Jaskola, W. Osadnicz, Z. Rogulski, J. Turkiewicz, and L. Zemlo 1970 12 p refs
(INR-1178) Avail: AEC Depository Libraries

The energy spectra of alpha particles from 166Er(n,alpha)163Dy and 168Er(n,alpha)165Dy reactions at 14.2 MeV were studied using the semiconductor detector technique. The analysis of the spectra leads to the conclusion that the evaporation theory is inadequate for the description of the reactions and that direct effects with the strong excitation of single neutron levels in the final nucleus are present. Author (NSA)

N71-13818# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EIKONAL REPRESENTATION FOR THE AMPLITUDE OF SPINOR PARTICLE SCATTERING ON AN ARBITRARY POTENTIAL
V. N. Pervushin 1970 14 p refs In RUSSIAN
(JINR-P2-5150) Avail: AEC Depository Libraries

An eikonal representation is obtained for the amplitude of Dirac particle scattering on an arbitrary potential. The cases of scalar, pseudoscalar, vector, axial, and tensor potentials are discussed. It is shown that at an infinitely high energy of a scattering particle the nonvanishing contribution to the spin-amplitude can be given only by tensor potential. Author (NSA)

N71-13626# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
MESON BEAM FOCUSING BY A MAGNETIC HORN
V. N. Folomeshkin 1969 31 p refs In RUSSIAN
(IFVE-SEF-69-73) Avail: AEC Depository Libraries

An analysis of various possible constructions for a magnetic horn (MG) is carried out. Definite optimum parameters of MG, the surface shape in the MG most narrow part, and the dependence of the MG optimum shape on the current distance up to the target are defined. The examples of neutrino spectra obtained at using MG are presented. Author (NSA)

N71-13629# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
RESEARCH ON SLOW ELECTRON COLLISION PROCESSES IN GASES Technical Progress Report, 15 Sep. 1969–31 May 1970
George C. Baldwin Jul. 1970 21 p refs
(Contract AT(30-1)-4144)
(RPI-4144-1) Avail: NTIS

Progress made during the period on an investigation of collisions of very slow electrons (below 2 eV) in gases with the aid of time-of-flight velocity selection is reported. Emphasis is on the apparatus and procedures; a diagram is shown and development of techniques is discussed. Some preliminary total-cross-section measurements on H2, O2, and N2 taken in the course of testing equipment and procedures are included. NSA

N71-13630# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DETERMINATION OF THE ABSOLUTE NEUTRON FLUX SPECTRUM IN THE PCTR FAST NEUTRON CAVITY FROM MULTIPLE FOIL ACTIVATION MEASUREMENTS
D. F. Newman Aug. 1970 138 p refs
(Contract AT(45-1)-1830)
(BNWL-1487) Avail: NTIS

A large Fast Neutron Cavity (FNC), which permits the flexibility of altering the neutron spectrum, has been developed and operated in the central region of the Physical Constants Testing Reactor (PCTR). Analysis of multiple foil activation measurements in the center of the FNC was made to obtain a set of infinitely dilute saturated activities for twenty-six reactions. Activation responses of these foils included the entire range of possible neutron energies in the FNC. The SAND-2 code was used for neutron spectrum determination from the experimental data. Neutron spectrum results unfolded from the multiple foil activation data were compared with proton recoil spectrometer measurements, in the center of the FNC, and with reactor theory calculations for this fast-thermal coupled reactor. Author (NSA)

N71-13632# Academia R.P.R., Bucharest. Inst. de Fizica Atomica.
PHOTONEUTRON CROSS SECTION FOR Co 59 AND ITS FINE STRUCTURE
G. Baciu, D. Catana, C. Deberth, C. Iliescu, and B. Cirstoiu 1970 5 p refs
(IFA-M-45) Avail: AEC Depository Libraries

The cross section for the (Co-59)(gamma, Sigma hyperon neutron) reaction has been measured from threshold to 22 MeV with a small energy bin (100 keV). Marked structure was observed in the total photoneutron cross section at several energies below and in the giant resonance. This structure of the cross section is ascribed to the dipole-quadrupole coupling influence. Author (NSA)

N71-13646# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF THE UPPER SHIELDING OF THE PHENIX REACTOR: COMPARISON BETWEEN S SUB N AND MONTE CARLO METHODS [ETUDE DE LA PROTECTION SUPERIEURE DU REACTEUR PHENIX: COMPARAISON ENTRE LES METHODES SN ET MONTE CARLO]
Jeanne Marie Lanore May 1970 14 p In FRENCH
(CEA-N-1351) Avail: AEC Depository Libraries

The neutron attenuation in B4C solutions, dense graphite and stainless steel were studied using the Monte Carlo POKER code. The results were compared with rough calculations made using the S sub N NIOBE code. Author (NSA)

N71-13647# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE pp YIELDS pp PION(+) PION(−) REACTION AT 8 GeV/c [ETUDE DE LA REACTION PP YIELDS PP PION(+) PION(−) A 8 GEV/C]
Tran Ha Anh (Ph.D. Thesis—Paris Univ., 1969) Mar. 1970 94 p refs In FRENCH
(CEA-N-1221) Avail: AEC Depository Libraries

The proton proton yields proton proton positive pion negative pion reaction was studied, using results obtained from the two meter bubble chamber at CERN, with an incident beam of 8 GeV/c protons. The cross sections for the various resonances occurring in this reaction were calculated; the most interesting features of the reaction were discussed and a general analysis of the mechanisms was made. Experimental results were compared to the results obtained using modified Deck and Berger models. The proton proton yields Delta hyperon(++) neutral hyperon reaction was also studied using peripheral models, with or without absorption, and then with the exchange of a Regge trajectory. Author (NSA)

N71-13648# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
ADLER'S NEUTRINO SUM RULES IN THE SCALING LIMIT AND THE POSSIBILITY OF A CHIRAL POMERON
E. Etim 26 Jun. 1970 8 p refs
(LNF-70/27; Rept-482) Avail: AEC Depository Libraries

The prediction that the ratio of neutrino–to antineutrino–nucleon total and differential cross sections with respect to the Bjorken variable is 3 to 1 is discussed. While previously it was argued that either the Pomeron is chiral or the Adler neutrino sum rules are trivially satisfied or badly violated, it is shown that this 3 to 1 ratio can be accommodated in a diffractive model of scaling. Thus it can be in no way implied that the Pomeron is chiral. NSA

N71-13649# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
THE SYSTEM OF MONOCHROMATIZATION OF THE EXTERNAL BEAM OF THE 2.4-METER ISOCHRONOUS CYCLOTRON OF THE KURCHATOV ATOMIC ENERGY INSTITUTE [SISTEMA MONOKROMATIZATSII VNESHNEGO PUCHKA 2.4-METROVOGO IZOKRONNOGO TSIKLOTRONA IAE IM I. V. KURCHATOVA]
Yu. G. Basargin, V. I. Bogdanova, N. I. Venikov, K. N. Korol, N. N. Poselskii, et al 1969 20 p refs In RUSSIAN
(IAE-1898) Avail: AEC Depository Libraries

The authors adduce the results obtained from designing a system of monochromatization of the external beam of the 2.4-meter cyclotron at Kurchatov, IAE in which use was made of the compensation of the energy dispersal of the beam by a high-frequency debuncher. The separation of the beam according to

pulses is accomplished with a special mirror-type symmetrical achromatic magnetic system. The proposal is made to improve the energy dispersal in the beam from + or − 0.2% to 0.02%. The authors have also examined the methods for the stabilization and smooth variation of energy in this system. Author (NSA)

N71-13650# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.

DETERMINATION OF BERYLLIUM BY GAMMA ACTIVATION

C. A. Kienberger 14 Sep. 1970 19 p refs
(Contract W-7405-eng-26)
(Y-1733) Avail: NTIS

A short, precise, and economical method was developed for determining the amount of beryllium in samples of beryllium metal, beryllium compounds, and beryllium oxide. The beryllium samples are prepared by dissolving them in a hydrofluoric acid solution or by compressing the powder in a stainless steel dish. The prepared samples are gamma activated with an antimony 124 source. The beryllium is determined by counting the neutrons produced and comparing the counting rate to that of a beryllium standard. The precision of a single analysis, at the 95 percent confidence level, is + or − 0.2 percent of the value. There is no significant bias in the analysis. An analysis can be made in about one-half hour. Author (NSA)

N71-13651# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF A NEUTRON DOSIMETER BASED ON ELECTRICAL RESISTIVITY CHANGES. TUNGSTEN DOSIMETER [ETUDE D'UN DOSIMETRE DE NEUTRONS PAR METHODE DE VARIATION DE RESISTIVITE ELECTRIQUE DOSIMETRE AU TUNGSTENE]

Michel Cance May 1970 135 p refs In FRENCH
(CEA-N-1288) Avail: AEC Depository Libraries

After a brief review of the main phenomena of creation of damage in metals, a study is made of the effect of in-pile neutron irradiation on the electrical resistivity of tungsten. The preparation of samples for irradiation and the technique of measurement, as well as the installation are described. A relationship is established between the measured effects and the neutronic characteristics on the irradiation. It is shown how in the region studied the method makes it possible to measure fluxes (tungsten equivalent fast flux). Author (NSA)

N71-13652# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

PROBLEM OF THREE INTERACTING PARTICLES INCLUDING BOUND STATES [DAS RELATIVISTISCHE DREIKOERPERPROBLEM MIT GEBUNDENEN ZUSTAENDEN]

Manfred Kudlek Jul. 1970 35 p refs In GERMAN; ENGLISH summary
(DESY-70/29) Avail: AEC Depository Libraries

A system of three interacting particles including bound states is considered. Annihilation or creation of particles is neglected. A representation space is constructed to give a consistent description of this system. Integral representations for the scattering operators of this many-body problem are deduced. Relations between different Lorentz frames are given for the transition operators, as well as between the 2 particle and 3 particle space. Finally it is shown how Faddeev equations have to be used. Author (NSA)

N71-13653# Joint Inst. for Nuclear Research, Dubna (USSR).

RELATIVISTIC SOLITONS AND NONLINEAR WAVES AS BUNCHES FOR COHERENT ACCELERATION

V. N. Tsytovich 1970 14 p refs In RUSSIAN
(JINR-P9-5090) Avail: AEC Depository Libraries

The structure of nonlinear waves and solitons with phase velocities near to the light velocity has been considered. Expressions for the maximum potential difference in such waves and the maximum electric field strength are given. The problems of excitation of these waves with the help of relativistic electron beams and relativistic electron rings have been discussed. The maximum electric field strength in solitons that are propagating across the magnetic field can be of the order of the external magnetic field strength. Author (NSA)

N71-13665# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

ON THE PROTON FORMFACTORS

S. I. Bilenkaya, Yu. M. Kazarinov, and L. I. Lapidus 1970 21 p refs In RUSSIAN
(JINR-P1-5178) Avail: AEC Depository Libraries

All the experimental data on the differential cross sections of the proton-electron scattering in the range of transmitted pulse 0.3 < or = q squared < or = 225/F squared were analyzed for determination of the proton form factors and radius. Different forms of the form factor dependence on q squared are considered. As a result the parameter values leading to the best description of the experimental data in different ranges of squared are obtained. It is shown that is is impossible to obtain statistically satisfactory description of all the available data for considered forms of the form factor parametrization. The data of different groups can be coordinated only by renormalization taking into account possible systematic errors. Their satisfactory description can be obtained only at q squared < or = 30/F squared. Author (NSA)

N71-13666# Akademiya Nauk URSR, Kharkov.

CONCERNING WAYS TO STABILIZE THE BASIC PARAMETERS OF THE BEAM OF A LINEAR ACCELERATOR OF ELECTRONS WITH ENERGY 2 GeV

I. A. Grishaev, V. I. Kolosov, V. D. Krasnikov, and V. V. Melnichenko 1969 6 p refs In RUSSIAN
(KHFTI-69-20) Avail: AEC Depository Libraries

The fundamental parameters, such as beam intensity, energy spectrum, divergence, etc. of the extracted beam of the electron accelerator were studied in order to determine the nature of the instabilities under steady state operation at 1200 MeV with a mean beam current of 0.3 to 0.4 microampere. The effects of injector accelerator system on the parameters of the accelerated electron beam were examined on the basis of static characteristics. The results indicated that the mean current of the klystron accelerator and the excitation phase are the most critical parameters. The analysis made it possible to select the optimum number of local stabilizers: one of them stabilizes the electron heating of the beam, the second maintains the phase of the electron clusters, the third stabilizes the energy of the accelerated electrons against the general drift of the system, while the fourth keeps the beam on the target. The large number of experimental devices prevent the dispatcher from considering the large volume of information; therefore, the system was automated, installing a central control board containing a digital controller and diagnostic instrumentation. NSA

N71-13667# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

CALCULATION OF A TWO-DIMENSIONAL MAGNETIC FIELDS USING IRREGULAR TRIANGULAR COORDINATE LATTICE

S. B. Vorozhtsov, L. T. Zakamskaya, and N. L. Zaplatin 1970 26 p refs In RUSSIAN
(JINR-P9-5013) Avail: AEC Depository Libraries

The method of coordinate lattice is used for calculation

of two dimensional magnetic fields for charged particle transport for accelerators. The program for a computer is prepared and the results of calculations are given. The comparison with the experimental data shows the accuracy of calculations to be 1%. Author (NSA)

N71-13668# Australian National Univ., Canberra. Dept. of Nuclear Physics.
[NUCLEAR PHYSICS RESEARCH AND INSTRUMENTATION] Annual Report, 1969
Jan. 1970 65 p refs
(ANU-P-484) Avail: AEC Depository Libraries

The activities of the A. N. U. Department of Physics for 1969 are presented. The staff, their publications, research equipment and research programs are detailed. NSA

N71-13669# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
POLARIZATION MEASUREMENT WITH DOUBLY ELASTICALLY SCATTERED DEUTERONS C 12 FOR ENERGIES BETWEEN 41 AND 51 MeV [POLAISATIONMESSUNGEN MIT DOPPELT ELASTISCHE GESTREUTEN DEUTERONEN AN KOHLENSTOFF 12 FUER ENERGIEN ZWISCHEN 41 UND 51 MeV
E. Seibt (Ph.D. Thesis--Karlsruhe Univ.) Jan. 1970 127 p refs In GERMAN
(NP-18301) Avail: AEC Depository Libraries

Polarization measurements with deuterons on C-12 between 41 and 51 MeV were carried out at the Karlsruhe isochronocyclotron using a double scattering device. This previously unstudied energy range is especially suitable for the study of the spin-dependent interaction terms in the optical potential. As a result of the small tensor polarization effects the energy and angular dependences of the vector polarization iT sub 11 were determined with the help of a calibration experiment, scattering on C-12 of unpolarized deuterons. The deuteron vector polarization shows an exceptionally strong angular dependence, but strong energy dependence was observed only at a scattering angle of 58 deg. The maximum value found for the deuteron vector polarization was +0.453 + or - 0.048. This value corresponds to a polarization degree of 52% of the maximum value consistant with pure vector polarization. Under these conditions C-12 is a good analyzer for the deuteron vector polarization with an extrapolated effective cross section of about 40 mb/sr. Author (NSA)

N71-13670# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.
ENERGY TRANSFER IN INTERACTIONS BETWEEN A LASER BEAM AND SOLID DEUTERIUM [TRANSFERT D'ENERGIE DANS LES EXPERIENCES D'INTERACTION LASER-DEUTERIUM SOLIDE]
J. Reuss Jun. 1970 31 p refs In FRENCH
(CEA-N-1337) Avail: AEC Depository Libraries

The energy transfer in interactions between a laser beam and solid deuterium is investigated theoretically. The absorption of the laser radiation, the re-emitted radiative energy, the electron conduction and the preheating front are considered. Author (NSA)

N71-13671# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SYSTEMATICS OF INELASTIC INTERACTIONS OF HIGH-ENERGY PIONS AND NUCLEONS WITH ATOMIC NUCLEI
V. S. Barashenkov, K. K. Gudima, A. S. Ilinov, and V. D. Toneev 1970 72 p refs In RUSSIAN
(JINR-P2-5118) Avail: AEC Depository Libraries

Within the intranuclear cascade model detailed and systematic Monte-Carlo calculations of various characteristics of inelastic interactions of pions and nucleons with atomic nuclei were performed in the energy region from a few dozens of MeV up to several GeV. Special attention was paid to the energy region where the pion production processes are essential. The given calculation data allow one to determine by interpolation the corresponding characteristics for intermediate energies and nuclei. Author (NSA)

N71-13672# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PRACTICAL CORRECTION PROGRAM FOR ELECTRON MICROANALYSIS USING COMPLEX STANDARDS [PROGRAMME PRATIQUE DE CORRECTIONS POUR MICROANALYSE ELECTRONIQUE PERMETTANT L'UTILISATION DE TEMOINS COMPLEXES]
Jean-Pierre Morlevat and Jean-Pierre Fialon Jun. 1970 29 p refs In FRENCH
(CEA-N-1289) Avail: AEC Depository Libraries

A computer program for electron microprobe analysis, which can be used with simple or complex standards, is described. Standards and specimens can contain up to eight elements, analyzed with various high voltages. Fluorescence, absorption, and atomic number effects are corrected respectively with Castaing and Reed's, Philibert's and Philibert-Tixier's methods. The determination of Si in the phase U Si(1.88) is made with the standard U3Si2. The Si concentration is measured and compared to that corrected. Author (NSA)

N71-13673# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
TIME TO PULSE HEIGHT CONVERTER WITH TIMING COMPENSATION FOR p-i-n DETECTORS [SELECTEUR DE TEMPS A COMPENSATION POUR DETECTEURS P-I-N]
R. Van Zurk and A. Mougin Jun. 1970 30 p refs In FRENCH; ENGLISH summary
(CEA-N-1334) Avail: AEC Depository Libraries

The leading edge timing walk, due to rise time variations of the stop pulses, was compensated by a system using a linear extrapolation method. The different factors which affect the time resolution are examined, and some experimental results in an energy range from 250 keV to 2.75 MeV are given. NSA

N71-13674# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
AUTOMATIC TRANSFER OF MATERIAL FROM THE REACTOR CORE AND VARIOUS ASSOCIATED PROBLEMS [TRANSFERT AUTOMATIQUE DU CONTAINER PILE ET DIFFERENTES FONCTIONS QUI EN DECOULENT]
Lucien Fremion Mar. 1970 14 p In FRENCH
(CEA-N-1265) Avail: AEC Depository Libraries

Experimental observations on short lived isotopes must be accomplished in the least time possible. These isotopes are obtained very rapidly from the core of the reactor using pneumatic methods. Sometimes the isotopes are present in such small concentrations that it is necessary to work with large quantities of active material; extensive shielding is required to protect the worker. It is for this reason that a fully automatic protecting manipulator was built. Author (NSA)

N71-13675# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF THE ISOTOPIC CONTAMINATION WITH THE TWO-STAGE GRENOBLE MAGNETIC SEPARATOR [ETUDE DE LA CONTAMINATION ISOTOPIQUE AVEC LE SEPARATEUR A DEUY ETAGES MAGNETIQUES DE

GRENOBLE]
Marc Boge (Ph.D. Thesis—Grenoble Univ.) Aug. 1970 93 p refs In FRENCH
(CEA-R-4043) Avail: AEC Depository Libraries

In order to know the limits of enrichment of the Grenoble electromagnetic isotope separator, the principal contaminations caused by ion scattering on the residual gas and by chromatism were studied. A second magnet was used with neodymium to analyze the ions which passed through the first stage slit. Therefore, the scattering with and without charge exchange of Nd(+) and the dissociation of NdO(+) were measured. The chromatism was studied by means of an electrostatic analyzer used as a third stage. The limits of enrichment were obtained for argon, uranium, and neodymium. Author (NSA)

N71-13676*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
QUADRUPOLE ION ENTRANCE MASK STUDY
Nov. 1970 75 p ref
(Contract NAS5-11185)
(NASA-CR-115781) Avail: NTIS CSCL 20H

The use of ion masking of the ion source in a quadrupole mass filter to eliminate the penetrating unstable ions that normally appear as tails on either side of the given mass peaks is discussed. Theoretical as well as extensive computer analyses of the unstable ions and the effect of masking upon these ions are covered. Results of these analyses show that the peak tails may be reduced by either an angle mask (elimination of small angles) or a position mask (elimination of small amplitudes). By use of the computer data it was possible to determine some relations of all the variables, which define the amplitudes and intensities of the unstable ions. These variables include initial angle of entrance, initial amplitude and phase as well as other parameters such as distance from the stability region, resolution, and number of rf cycles the ion spends in the quadrupole. The relationship of mask size to tail intensity is also developed. Also covered are experimental results of quadrupole runs with and without masking (amplitude masking), which show considerable improvement of operation of the quadrupole filter when masking is utilized. These test results show good agreement with the analytical predictions. Author

N71-13680# Toulouse Univ. (France). Faculte des Sciences.
STUDY OF THE ATMOSPHERIC DIFFUSION BY A GASEOUS RADIOACTIVE TRACER [ETUDE DE LA DIFFUSION ATMOSPHERIQUE A L'AIDE D'UN INDICATEUR RADIOACTIF GAZEUX]
Bertrand Rouzaud (Ph.D. Thesis) 1970 87 p refs In FRENCH; ENGLISH summary
(NP-18349) Avail: AEC Depository Libraries

The diffusion of Rn-220 from a point source of Th-228 (120 mCi) was studied. The device for the measurement of Rn-220 is described and the results given. A numerical model is used for the resolution of the diffusion equation. Author (NSA)

N71-13682# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
MODEL OF LEPTONS
J. Hosek 1970 5 p
(UJV-2435-F) Avail: NTIS

A scheme for the weak leptonic interactions is presented in which the leptons interact via neutral spin-1 mesons. Author (NSA)

N71-13683# Hamburg Univ. (West Germany). Inst. fuer Theoretische Physik.
DIFFRACTION-DISSOCIATION MODEL FOR HIGH-ENERGY RHO-PHOTOPRODUCTION
G. Kramer and H. R. Quinn (DESY, Hamburg) May 1970 51 p refs Prepared in cooperation with DESY, Hamburg
(DESY-70/23) Avail: AEC Depository Libraries

A model for two-pion photoproduction in the rho-resonance region is constructed. The production proceeds by diffraction dissociation of a photon into a pion pair which interacts strongly in the p-wave state. The effects of initial and final absorptive interaction with the proton are also included. Particular attention is paid to the invariant-mass spectrum of the dipion system. Author (NSA)

N71-13684# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ENERGY TRANSFERRED TO A ZIRCONIUM LATTICE IRRADIATED BY NEUTRONS [ENERGIE CEDEE PAR LES NEUTRONS A UN RESEAU DE ZIRCONIUM]
Bertrand Barre and Christian Devillers Aug. 1970 11 p refs In FRENCH
(CEA-N-1332) Avail: AEC Depository Libraries

The neutron energy spectra greatly influence the creep of Zircaloy under irradiation. The DOMISOL program was used to determine the energy transferred to the lattice by elastic and inelastic collisions, and radiative capture. Author (NSA)

N71-13686# Sandia Corp., Albuquerque, N.Mex.
SOME RESULTS ON AUGER TRANSITION RATES INVOLVING f ELECTRONS
Eugene J. Mc Guire Aug. 1970 27 p refs Sponsored by AEC
(SC-RR-70-429) Avail: NTIS

Expressions for the total Auger transition rate for an initial l sub 1 and final l sub 3 and l sub 4 = f holes are found, where l sub 1 and l sub 3 = s, p, d. Expressions are also found for the fine structure in Auger spectra for l sub 1 = p, antiproton, l sub 3 = p,antiproton, and l sub 4 = f,f(barred), in J-J coupling. Finally an expression is found for the summed fine structure, summed over j sub 2 J and j sub 4. Author (NSA)

N71-13687# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NEUTRON PHYSICS FOR MAGNETIC STRUCTURES
E. F. Bertaut 1969 26 p refs
(CEA-Conf-1515) Avail: AEC Depository Libraries

Topics covered are: structure factors; the Born approximation; nuclear and magnetic amplitudes; polarized neutrons; and polarization analysis. NSA

N71-13688# United Kingdom Atomic Energy Authority, Harwell (England).
THE MEASUREMENT OF SMALL DIMENSIONAL CHANGES BY NEUTRON RADIOGRAPHY Progress Report
R. S. Matfield, G. Constantine, and S. C. Alexander Jul. 1969 64 p
(AERE-R-6782) Avail: AEC Depository Libraries; UK 12s0d

A general description of the theory and practice of neutron radiography, with special emphasis on the techniques suitable for use with radioactive materials, is given. The application of the transfer method, using a radioactive foil to produce an image on a photographic film, was studied and subsequently developed for the nondestructive measurement of the dimensional changes of samples with in a radioactive in-pile experiment. The accuracy tentatively claimed is +0.001/-0.003 in., and further work is recommended since the technique used may be capable of further refinement. A few experiments were conducted with a boron foil and cellulose acetate film, and further work on alternatively materials is suggested. The appendix gives comparative examples of X-radiographs and neutron radiographs to demonstrate the use of neutron radiography as an inspection technique. Author (NSA)

N71-13689# European Organization for Nuclear Research, Geneva (Switzerland).
MEASUREMENT OF PI PI INELASTIC SCATTERING CROSS-SECTION IN THE REGION OF 1 GeV INVARIANT MASS
B. D. Hyams, W. Beusch, and A. D. Johnson 1970 18 p refs Presented at Conf. on Exptl. Meson Spectry., Philadelphia, Apr. 1970 Sponsored by AEC
(UH-511-74-70; Conf-700525-5) Avail: NTIS

The cross section of the interaction pion(−) + pion + yields K(+) + K(−) was studied in the interaction pion(−) + proton yields K(+) + K(−) n at 11 GeV/c. The cross section of the interaction pion (−) + pion(+) yields K(0)1 + K(0)1 was studied in the interaction pion(−) + pion(+) yields K(0)1 + K(0)1 + n at 6 and 12 GeV/c. And lastly the cross section of the interaction pion(−) + pion (+) yields 2 pion(+) + 2 pion(−) was studied in the interaction pion(−) + proton yields 2 pion(+) + 2 pion(−) + n at 3.9 GeV/c. It is found that the pion + pion T = 0 s-wave scattering becomes highly inelastic within the first 30 MeV above the kaon antikaon threshold. NSA

N71-13690# Uppsala Univ. (Sweden). Inst. of Physics.
INFLUENCE OF TRAPPING ON THE CURRENT PULSE IN SILICON DETECTORS SHOWING PLASMA EFFECTS
W. Seibt, K. E. Sundstroem, and P. A. Tove May 1970 13 p refs
(UUIP-710) Avail: AEC Depository Libraries

"Current pulse shapes in silicon detectors for strongly ionizing particles giving plasma effects are presented and discussed. It is shown that under certain circumstances trapping and detrapping occur which give a tail in the current pulse. Complementary views, relative to a previous report, are given concerning the rise time of the pulse. Author (NSA)

N71-13691# Institute of Nuclear Research, Warsaw (Poland).
BINDING ENERGY OF A LAMBDA PARTICLE IN NUCLEAR MATTER WITH THE NEW HERNDON-TANG LAMBDA-N POTENTIALS [ENERGIA WIAZANIA CZASTKI LAMBDA MATERII JADROWET DLA NOWYCH POTENCJALO LAMBDA-N HERNDONA-TANGA]
J. Dabrowski and M. J. M. Hassan 1970 5 p refs In POLISH; ENGLISH summary
(INR-P-1191) Avail: AEC Depository Libraries

The binding energy of a Lambda hyperon particle in nuclear matter, B sub Lambda (infinity), was calculated with the new Lambda hyperon-nucleon potentials of Herndon and Tang. The resulting values of B sub Lambda (infinity) lie between 38.7 and 49.5 MeV. Thus, with the new potentials, the problem of overbinding of a Lambda hyperon particle in nuclear matter remains essentially unchanged. Author (NSA)

N71-13692# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.
ON AXIAL FLOW DYNAMICS IN STATIONARY ROTATION SYMMETRICAL DISCHARGES OF HIGH POWER CURRENTS [UEBER AXIALE STROEMUNGSVORGAENGE IN INSTATIONAEREN ROTATIONSSYMMETRISCHEN ENTLADUNGEN HOHER STROMSTAERKE]
Klaus Kirbach (Ph.D. Thesis) 1970 24 p refs In GERMAN
Avail: NTIS

Plasma flows in brief, oscillating high-intensity gas discharges are analyzed. It is shown that axial flows develop in stationary rotational symmetrical high-intensity discharges. Flow velocities of the order of 10 km/s are of supersonic character and are caused by the following discharge mechanisms: (1) axial component of the Lorentz force resulting from a pinch effect; (2) evaporation of the electrode; (3) electrical field effect on charged particles; and (5) pinch effect at the electrode. Transl. by G.G.

N71-13693# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.
STUDY ON THE HYPERFINE STRUCTURE OF THE z 6P7/2 STATE IN STABLE EUROPIUM ISOTOPES WITH THE HELP OF THE LEVEL CROSSING METHOD [UNTERSUCHUNG DER HYPERFEINSTRUKTUR DES z 6P7/2-TERMS DER STABILEN Eu-ISOTOPE MIT DER METHODE DES LEVELCROSSINGS]
Wulfhard Lange (Ph.D. Thesis) 1970 24 p refs In GERMAN
Avail: NTIS

The hyperfine structure of the 4f 7(8S)6s6p z 6P1/2 level of europium 1 was studied by the level crossing method in a magnetic field. In the 0.5 to 40 Oe region 22 crossings were observed. Signal ordering to definite crossings and distribution to the two stable europium isotopes were obtained by systematic evaluation of all crossing signal distribution possibilities. Eigenfunctions of cross couplings and theoretical analysis of the hyperfine fission in the configuration 4f 7(8S)6s6s produced the A-factors for nine of the twelve terms. Quadrupole moments were calculated from measured B-factors. Transl. by G.G.

N71-13698# Institute of Nuclear Physics, Krakow (Poland).
STRUCTURE FACTOR AND EXCITATION SPECTRUM OF THE MANY-BODY SYSTEM CALCULATED BY THE DECOUPLING OF GREEN FUNCTION
K. Parlinski 1970 19 p refs
(INP-705) Avail: AEC Depository Libraries

Using the method of retarded Green function, the system of self-consistent equations for the radial distribution function and the excitation spectrum of a many-body system are found. The simplest approximation is used, in which the elementary excitations are not damped. The Feynman relation for the structure factor, and the Hubbard−Beeby formulas of the self-energy spectrum of collective excitations in liquids is involved in this system. The properties of classical and quantum liquids are described qualitatively. Author (NSA)

N71-13699# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF ION COLLISIONS USING AN ISOTOPE SEPARATOR WITH TWO MAGNETIC STAGES AND AN ELECTROSTATIC STAGE [ETUDE DE COLLISIONS IONIQUES A L'AIDE D'UN SEPARATEUR D'ISOTOPES A DEUX ETAGES MAGNETIQUES ET UN ETAGE ELECTROSTATIQUE]
Marc Boge May 1970 4 p In FRENCH Presented at 4th Symp. on Atomic and Electronic Collisions, Brest, France, 13−15 May 1970
(CEA-CONF-1571; CONF-700532-1) Avail: AEC Depository Libraries

The mode of operation of the Grenoble isotope separator is reviewed. The high temperature ion source (3000 C) is maintained at 50 kV and can deliver ion beams directly from the elements introduced. The principal causes of isotopic contamination were investigated in order to know the limits of enrichment of this separator and were found to be: the scattering of residual gas with subsequent neutralization (charge exchange), the dissociation of compound beams, the scattering of residual gas without charge exchange, and charge exchange occurring at the ion source exit. Author (NSA)

N71-13700# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STABILIZATION OF THE BEAM OF AN ISOTOPE SEPARATOR [STABILISATION DU FAISCEAU D'UN SEPARATEUR D'ISOTOPES]
Christian Ristori Jun. 1970 15 p In FRENCH

(CEA-R-3999) Avail: AEC Depository Libraries

Stabilizing devices which were constructed greatly reduce ion beam scattering in collector tanks of isotope separators. A 0.01 (in five minutes) variation in beam position is reduced to 0.00001 (in half an hour) when the stabilizer is connected. A very low level amplifier of very high gain makes suitable stability obtainable even with very low intensity ion beams. Author (NSA)

N71-13745# Joint Inst. for Nuclear Research, Dubna (USSR).
ON A TEMPORARY EFFECT OF THE ACCELERATING FIELD ON THE ELECTRON BUNCH CONTAINING IONS
A. G. Bonch-Osmolovskii 1970 12 p refs In RUSSIAN
(JINR-P9-5142) Avail: AEC Depository Libraries

A problem of a temporary effect of the field on the electron bunch containing ions is considered. The conditions are derived under which the ions are confined within the geometrical dimensions of the bunch to a single and recurrent action of the field accelerating the bunch. Author (NSA)

N71-13746# Joint Inst. for Nuclear Research, Dubna (USSR).
ON THE FEASIBILITY OF POLARIZED PROTON ACCELERATION WITH AN ELECTRON RING ACCELERATOR
L. I. Lapidus, Yu. A. Plis, V. P. Sarantsev, and L. M. Soroko 1970 18 p refs In RUSSIAN; ENGLISH summary
(JINR-P1-5209) Avail: AEC Depository Libraries

The electron ring accelerator may be useful for the production of polarized particles of high intensity because polarized ions are accumulated in the electron ring during the time of injection (approximately 1 msec). The crucial problem is to conserve polarization during the time of injection and acceleration. The estimations of P show that a decrease in the number of electrons is necessary for producing polarized ions with a high polarization degree. Fortunately, the limit is rather high for the projected parameters of the compressor. The polarized proton beam after acceleration will have longitudinal polarization, which can be changed to transversal polarization, if necessary. The sign of polarization can be changed for every pulse that gives possibilities for valid experiments on the P, T-parity conservation. Some essential experiments are discussed. Author (NSA)

N71-13747# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MATHEMATICAL PROBLEMS IN MULTICHANNEL SCATTERING THEORY
B. N. Zakharev and V. L. Shmonin 1970 19 p refs In RUSSIAN
(JINR-P4-5168) Avail: AEC Depository Libraries

The complexity of the calculations in the multichannel scattering theory makes very important the following problem: to what degree the correspondence between the initial data of the problem and the result can be violated by the effect of numerous sources of errors appearing inevitably when solving the problems. The review of modern notions about the mathematical structure of direct methods, consituting the basis of the multichannel theory approaches, as well as about the nature of the sources of errors and mechanism of their effect on the results is presented. Author (NSA)

N71-13748# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
ABSORPTION MODEL FOR DIRECT TRANSFER REACTIONS
J. Dobes 1970 24 p
(UJV-2433-F) Avail: AEC Depository Libraries

A simple model for direct transfer reactions is investigated. The transition amplitude is evaluated by means of the geometric mean (Sopkowich) formula with the sharp cut-off model for elastic scattering. Any easy numerical computation removing a number of approximations adopted in previous papers is performed. The model is tested for some (d,p) and (p,d) reactions. Satisfactory agreement with experimental angular distributions and reasonable spectroscopic factors have been obtained. Author (NSA)

N71-13749# California Univ., Los Angeles.
SOLID STATE AND MOLECULAR PHYSICS Progress Report, 1 Jan. 1969 – 30 Apr. 1970
30 Apr. 1970 33 p refs
(Contract AT(11-1)-34)
(UCLA-34-P-88-30; PR-8) Avail: NTIS

Research projects in molecular and solid state physics are discussed. Subjects presented are: (1) electronic and vibrational spectra of ionic solids under high pressure, (2) lattice dynamics of solids under high pressure, (3) radiation damage, (4) chemiluminescence of hydrocarbons, and (5) optical spectra of polyscenes. P.N.F.

N71-13774# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
FISSION PRODUCT REMOVAL FROM THE COVER GAS OF A VENTED FUEL FBR
L. Barilli, L. Bruzzi, and J. C. Shorrock 18 Mar. 1970 25 p refs Presented at the Intern. Congr. on the Diffusion of Fission Prod., Saclay, France, 4 - 6 Nov. 1969
(RT/ING/70/7; Conf-691104-5) Avail: AEC Depository Libraries

The feasibility of a clean-up system for the cover gas of a fast reactor operating with vented fuel is studied. Both helium and argon have been considered as cover gas; physical absorption methods of Kr and Xe on activated charcoal at low temperature have been used for the purification of gas. The clean-up system is composed of four purification units: the first three beds, which operate in breakthrough, have been designed to delay Xe-133 and to remove decay heat; the fourth, which operates as a trap, provides for the removal of the remaining isotopes. A purification flow rate of 5.5 cover gas changes/hour has been chosen in order to obtain a reduction factor 1000 in the cover gas specific activity. Author (NSA)

N71-13775# Forsvarets Forskningsanstalt, Stockholm (Sweden).
STUDIES OF MIXED FISSION PRODUCTS FROM THERMAL FISSION OF U-235 WITH A Ge(Li) DETECTOR. [STUDIER AV BLANDADE FISSIONSPRODUKTUR FRAN TERMISK FISSION AV 235U MED Ge(Li)-DETEKTOR]
L. E. De Geer Apr. 1970 19 p refs In SWEDISH
(FOA-4-4420-28) Avail: AEC Depository Libraries

Gamma spectra from fission products of reactor-irradiated U-235 were recorded with a 7.2 cu cm crystal and analyzed by a 1600-channel analyzer. The Ge(Li) detector was shown to be superior to the NaI detector for analysis of complicated spectra. A data table is presented with the counting rate for every known actual photopeak. The purpose of the work was to create tools for the analysis of fallout from nuclear explosions. NSA

N71-13786# Vanderbilt Univ., Nashville, Tenn. Dept. of Physics.
GAMMA-RAY ENERGY MEASUREMENTS OF TRANSITIONS FROM THE FIRST AND SECOND EXCITED LEVELS OF Fe 58
N. C. Dyer, A. C. Reeter, W. Croft, and J. H. Hamilton [1969] 6 p refs Presented at the Intern. Conf. on Radioactivity in Nucl. Spectry., Tech. and Appl., Nashville, 11-15 Aug. 1969 Sponsored in part by NSF
(Contract AT(40-1)-2401)
(Conf-690818-7) Avail: NTIS

The gamma-ray energy spectra for the Co-58 yields Fe-58 decay

were measured with a Ge(Li) detector. The transition energies in Fe-58 are compared with previous data from Mn-58 decay and Fe-57 (n,gamma) reactions. NSA

N71-13816# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

SOME MONTE CARLO CALCULATIONS OF THE THERMAL NEUTRON DIFFUSION AREA IN A FUELLED CELL

P. W. Johnson May 1970 10 p refs

(RD/B/N-1674) Avail: AEC Depository Libraries

A Monte Carlo program was written to test Blackburn's proposed correction to the neutron diffusion coefficient. For the cell studied, a correction of $-(17.4 + \text{or} - 2.1)\%$ was observed, in excellent agreement with the Blackburn prediction. Author (NSA)

N71-13863# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

GEOMETRICAL INTERPRETATION OF THE SCALE INVARIANCE

S. Ferrara and G. Rossi 16 Jul. 1970 6 p refs

(LNF-70/34) Avail: AEC Depository Libraries

The scaling law for structure functions for the inelastic form factors, which is experimentally observed in inelastic electron + proton scattering is discussed. A possible geometrical interpretation of this law is given starting from the observation that an external Lorentz group acts in a natural way on the functions of two complex variables leading to the same consequences. NSA

N71-13865# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

ANALYSES OF THE CALCULATION METHOD FOR CONTROL RODS: COMPARISON WITH ROSSI ALPHA MEASUREMENTS [ANALISI DI METODI DI CALCOLO PER BARRE DI CONTROLLO. CONFRONTO CON MISURE DI ALFA DI ROSSI]

S. Fiorentino, M. Michelini, and L. Torelli 15 Dec. 1969 75 p refs In ITALIAN

(RT/FI/70/5) Avail: AEC Depository Libraries

The most advanced method of calculation for control rods is the P sub 1 blackness theory. The accuracy of the method is evaluated, both from the purely spatial effect standpoint (by comparing with DP3 transport calculations) and from the general (spatial + energetic) standpoint by comparing with Rossi-alpha measurements. Author (NSA)

N71-13869# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

THE CALCULATION OF NEUTRON CROSS SECTIONS AT ENERGIES BETWEEN 0.5 MeV AND 15 MeV

W. K. Bertram Apr. 1970 16 p refs

(AAEC/TM-536) Avail: AEC Depository Libraries

The optical model is used to calculate the elastic, nonelastic, and total cross sections for scattering of neutrons, with energies between 0.5 and 15 MeV, but nuclei in the mass range $65 < \text{or} = \text{to } A < \text{or} = \text{to } 160$. A simple method for determining the compound elastic scattering cross section is given. Author (NSA)

N71-13870# Ceskoslovenske Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

SEPARATED TURN ISOCHRONOUS CYCLOTRON WITH NONSINUSOIDAL FORM OF THE RADIO-FREQUENCY FIELD

M. Kuzmisk and M. Recman 1970 19 p refs In RUSSIAN; ENGLISH summary

(UJV-2425-A) Avail: AEC Depository Libraries

The peculiarities of isochronous cyclotron with separated orbits and turns are considered. The process of acceleration by means of nonsinusoidal form of ratio frequency field is described. The conditions for obtaining turn separation are analyzed. The oscillations are not discussed. The investigation concerns the particles moving along the equilibrium paths. Author (NSA)

N71-13871# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

LOGICAL AND MATHEMATICAL SCHEME FOR THE DIGITAL CALCULATION OF THE CROSS SECTIONS OF INELASTIC ELECTRON SCATTERING BY THE PHASE SHIFT METHOD

Christian Bardin, Yves Dandeu, and Jean-Claude Samour Jul. 1970 42 p In FRENCH

(CEA-N-1259) Avail: AEC Depository Libraries

The treatment was made according to the following plan: the transformation of the expression of the cross section sigma sub e (theta) and sigma sub m (theta) was made. The series giving sigma sup IJ sub LM (theta) and mu sup IJ sub LM (Theta) were calculated and their convergence was studied. A general flow chart was given and numerical methods were proposed. The flow chart was then examined in detail. Author (NSA)

N71-13872# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

MINIATURE FISSION CHAMBERS CFUE22-CFUE32

Eugene Baconnet, Jean Duchene, and Paul Farcy 9 Feb. 1970 31 p refs In FRENCH

(CEA-N-1298) Avail: AEC Depository Libraries

The fission chambers considered are built into a stainless steel aluminized triaxial structure with a built-in insulated triaxial semi-rigid cable having a characteristic impedance of 50 ohms and a length of up to 12 meters. The diameter of the chamber is 8mm and that of the cable 6mm. The sensitivities of the two types are respectively .01 c/s and .001 c/s for a flux of 1 n/sq cm/s. These chambers which support high neutron fluxes and strong gamma radiations are studied for their possible applications at high temperatures (600 C). NSA

N71-13874# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR).

OPERATION OF A COUNTER FILLED WITH He 3 IN VARIABLE HIGH-INTENSITY GAMMA FIELDS [RABOTA SCHETCHIKA S NAPOLNENIEM GELIEM-3 V PEREMENNYKH GAMMA-POLYAKH

V. K. Bogatyrev, V. V. Frolov, B. G. Dubovskii, and V. V. Charychanskii 1969 27 p refs In RUSSIAN

(FEI-178) Avail: AEC Depository Libraries

Data on the registration of neutrons against a strong background of gamma-radiation, with the use of counters filled with He-3, are of gamma-radiation, with the use of counters filled with He-3, are presented. It is shown that a counter operating under conditions of high gas-amplification is not effective in gamma fields exceeding 10 roentgens per hour. Factors affecting the insensitivity of the SMN-18 counter filled with He-3 up to 4 atmospheres pressure, to gamma-radiation, are discussed. Author (NSA)

N71-13875# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

DUMOS: PROGRAM FOR CALCULATION OF FREE VIBRATIONS IN RECTILINEAR ELASTIC ELEMENTS [DUMOS-PROGRAMMA PER IL CAICOLO DI VIBRAZIONI LIBERE IN ELEMENTI ELASTICI RETTILINEI]

G. Dusi and R. Mosiello 20 Feb. 1970 45 p refs In ITALIAN

(RT/ING-(70)5) Avail: AEC Depository Libraries

Aspects of free flexural undamped vibration are examined. A digital code was usad to find natural frequencies and normal modes of transverse vibration of a straight continuous beam is described. General restraints can be considered, while mass distribution is allowed to change step by step. Where necessary, shear deflection and rotary inertia effects can be introduced. Up to nine modes of vibration can be plotted on a diagram. Author

N71-13976# Wisconsin Univ., Madison. Dept. of Physics.
SUGGESTIONS FOR FAST NEUTRON DOSIMETER TECHNIQUES
P. R. Moran and E. B. Podgorsak [1969] 12 p refs
(Contract AT(11-1)-1105)
(COO-1105-155) Avail: NTIS

Fast neutron interaction processes with matter are reviewed, and general considerations for neutron damage defect state detection are outlined. Neutron defect detection based on photoexcitation fluorescence, metastable exciton properties, photoconductivity, Raman scattering, and Rayleigh scattering is discussed. Ammonium salts, silver activated ammonium salts, cyclic hydrocarbons, and simple grouped organics are suggested as materials. NSA

N71-13977# Los Alamos Scientific Lab., N.Mex.
PHASE-SPACE VOLUME OF ANGULAR CORRELATIONS FOR REACTIONS OF THE TYPE A + B YIELDS C + D + E FOR THE CASE OF ARBITRARY PARTICLE MASSES
V. K. Suslenko Aug. 1970 4 p refs Transl. into ENGLISH from the Russian Report
(LA-TR-70-15; JINR-P2-4914) Avail: NTIS

The phase-space relativistic expressions for angular correlations of particles in the final state of the reaction A + B yields C + D + E were derived for the case of arbitrary masses of particles involved in the given reaction. Author (NSA)

N71-13978# Purdue Univ., Lafayette, Ind.
STUDY OF DELTA(++) PRODUCTION IN TWO PRONGED PION(+) PROTON INTERACTIONS AT 13.1 GeV/c
J. H. Scharenguivel, H. R. Barton, Jr., L. J. Gutay, S. L. Kramer, S. Lichtman et al [1969] 13 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev Sponsored in part by AEC
(COO-1428-232; Conf-700806-26) Avail: NTIS

The production and decay angular distributions of the reactions pion(+) proton yields pion(0) Delta(++) hyperon and pion(+) proton yields eta(0)-meson Delta(++) hyperon were studied. The data came from a sample of 70 K two-pronged events a 13.1 GeV/c incident pion(+) momentum. Author (NSA)

N71-13979# Hawaii Univ., Honolulu.
FEATURES OF THE REACTION PION(-) PROTON YIELDS PION(-) PION(-) PION(-) PION(+) PION(+) PROTON AT 3.9 GeV/c
K. Abe, A. D. Johnson, V. J. Stenger, and P. G. Wohlmut Apr. 1970 18 p refs Presented at the Colloq. on High Multiplicity Hadronic Interactions, Paris, May 1970
(Contract AT(04-3)-511)
(UH-511-65-70; Conf-700528-1) Avail: NTIS

Experimental data are presented for 459 events of the reaction pion(-) proton yields pion (-) pion(-) pion(-) pion(+) pion(+) proton at 3.9 GeV/c. The results are compared with a model of incoherent resonance production with constant production amplitudes. Little peripheralism is observed. Multiparticle correlation effects are seen which appear to result from a combination of Bose statistics and resonance reflections. Author (NSA)

N71-13980# Chicago Univ., Ill.
QUARK FOCUSING AT HADRONIC VERTICES
Paul H. Frampton and Peter G. O. Freund Aug. 1970 29 p refs
(Contract AT(11-1)-264)
(COO-264-556; EFI-70-44) Avail: NTIS

A basis for a dual theory of processes that involve external and/or intermediate exotic hadrons is found in the form of a quark focusing principle. This principle, derived from the conformal invariance of the theory, requires that at a hadronic vertex all active quarks be focused to a point of their world sheet and act together (as a point-like particle) in the transfer of momentum. It is found that all hadronic couplings (including the coupling of any three exotic hadrons) can be expressed in terms of a single coupling constant. Applications to BB (barred) scattering are made. Author (NSA)

N71-13984# Oak Ridge National Lab., Tenn.
TABLES OF CLASSICAL SCATTERING INTEGRALS
Mark T. Robinson Sep. 1970 168 p refs
(Contract W-7405-eng-26)
(ORNL-4556) Avail: NTIS

Values of the apsis, the barycentric scattering angle, the relative transferred energy, the time integral, and the differential scattering cross section are tabulated as functions of the impact parameter and the relative kinetic energy for each of four inter-atomic potential functions. Classical mechanics was used throughout the calculations. The potentials used are the Born–Mayer (exponential), the Bohr (exponentially screened Coulomb), and the Moliere and Sommerfeld approximations to the Thomas–Fermi potential. These tables are a revised and greatly extended edition of an earlier tabulation. Auxiliary tables compare the Moliere and Sommerfeld approximations with the Thomas–Fermi screening function and the effects on the tabulated integrals of alterations in the quadrature procedure. Author (NSA)

N71-13985# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CREEP ANALYSIS OF STATICALLY INDETERMINATE BEAMS
W. H. Sutherland and V. B. Watwood, Jr. Jun. 1970 61 p refs
(Contract AT(45-1)-1830)
(BNWL-1382) Avail: NTIS

A general finite element analysis procedure was defined which will permit the creep analysis of statically indeterminate beams of arbitrary cross section using the same structural idealization as used for conventional beam theory. Furthermore, any incremental functional representation for the creep law can be accommodated. Provision was made in the formulation to consider the time dependent loading condition resulting from material swelling and time varying mechanical and thermal loads. Results are presented for a cantilever beam and a conceptual fast test reactor (FTR) flow duct. Author (NSA)

N71-13986# Wisconsin Univ., Madison. Dept. of Physics.
SUPRALINEARITY OF UV REPOPULATED TL FROM TLD-100
D. W. Pearson and J. R. Cameron [1969] 6 p refs
(Contract AT(11-1)-1106)
(COO-1105-156) Avail: NTIS

Samples of TLD-100 were irradiated with different exposures of cesium-137 gamma radiation, heated to 300 C, exposed to ultraviolet radiation, and the repopulated thermoluminescence curve measured. The repopulated thermoluminescence versus initial gamma exposure is plotted. A region of supralinear behavior is seen between 1,000 and 30,000 R. NSA

N71-13987# Oak Ridge National Lab., Tenn.
COMPILATION OF UNITED STATES NUCLEAR STANDARDS
Jul. 1970 177 p refs 6th Edition
(Contract W-7405-eng-26)
(ORNL-NSIC-76) Avail: NTIS

Standards information that might be of value to an individual in the nuclear community is compiled and presented in tabular form. The technical, industrial, and environmental organizations are listed alphabetically and their standards activities are given. In addition, standards are indexed by permuted title for location by a specific topic. NSA

N71-13988# Addis Translations International, Woodside, Calif.
BUILDUP OF GAS DISCHARGES IN THE PROPORTIONAL AND GEIGER REGION FOR USE IN CHARPAK CHAMBERS
H.-J. Stuckenberg [1970] 33 p refs Transl. into ENGLISH from the German Report Prepared for Stanford Linear Accelerator Center
(SLAC-Trans-121; DESY-69/49) Avail: NTIS

The gas discharge process of ionization chambers operating in the proportional and in the Geiger – Mueller regions is described. The discharge process is studied for both self-quenching gas fillings and non self-quenching gases. NSA

N71-13989# Oak Ridge National Lab., Tenn.
ENERGY LOSSES, RANGE, AND BREMSSTRAHLUNG YIELD FOR 10 keV TO 100 MeV ELECTRONS IN SOME SIMPLE ELEMENTS AND SOME CHEMICAL COMPOUNDS
Lucien Pages et al Jul. 1970 137 p refs Transl. into ENGLISH from the French Report
(ORNL-TR-2331; CEA-R-3942) Avail: NTIS

The study of tissue-equivalent materials for dosimeters necessitates calculation of some physical characteristics (particularly the electron stopping power) of mixtures studied. In order to determine the stopping power, the energy losses by ionization and bremsstrahlung were calculated separately. The energy losses by ionization were calculated from the Bethe "slowing down" theory. Moreover, in order to take the density effect into consideration, the basic functions established by Fermi were used instead of usual empirical relations. The energy losses by emission of Bremsstrahlung were calculated according to the formulas proposed by Koch and Motz. A program was developed and written in FORTRAN IV for an IBM 360-91 computer. The stopping powers, the range, and the bremsstrahlung yields of electrons with energy between 10 keV and 100 MeV were calculated according to this program (particularly for all the elements used in the development of tissue-equivalent mixtures). NSA

N71-13990# Stanford Linear Accelerator Center, Calif.
TRANSPORT/360: A COMPUTER PROGRAM FOR DESIGNING CHARGED PARTICLE BEAM TRANSPORT SYSTEMS
Karl L. Brown and Sam K. Howry Jul. 1970 394 p refs
(Contract AT(04-3)-515)
(SLAC-91) Avail: NTIS

TRANSPORT/360, a computer program for the design of static-magnetic beam transport systems based upon a first and second order matrix theory of beam transport optics, is presented. Included are: (1) a users manual describing how to prepare data sheet for a TRANSPORT computation; (2) specific examples of simple and complex TRANSPORT computations to illustrate first order fitting techniques; (3) a set of flow charts; and (4) an appendix containing the underlying optics theory behind the program. NSA

N71-14004# Atomic Energy Commission, Washington, D.C. Div. of Operational Safety.
SECOND INTERNATIONAL CONFERENCE ON ACCELERATOR DOSIMETRY AND EXPERIENCE
[1970] 872 p refs Conf. held at Stanford, Calif. 5-7 Nov. 1969 Sponsored in part by Stanford Linear Accelerator Center
(Conf-691101) Avail: NTIS HC$10.00/MF$0.65

Conference proceedings are documented with emphasis on electron accelerator problems and low energy (less than 100 MeV) machines. The proceedings comprise 50 papers and transcripts of the question and answer sessions. E.C.

N71-14010# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE ABSORPTION SPECTRUM OF GD (3+) IN CRYSTALS OF ALKALINE EARTH FLUORIDES: HEXTET D ENERGY LEVELS
Donald McEwen Ware (M.S. Thesis) Jun. 1970 66 p refs
(AD-712687; GNE/PH/70-15) Avail: NTIS CSCL 20/12

The splitting of the hextet D(7/2) and hextet D(9/2) energy levels of Gd(3+) ions in CaF2, SrF2, and BaF2 hosts was measured through absorption experiments at 77K. For each host, crystals with several doping concentrations from 0.1 to 0.85 mole % were used so that line growth patterns could be studied. Comparisons with previously identified lines of the hextet P transitions were helpful in identifying the location of the charge compensating ion that produces the various crystal fields. The sites identified in the hextet D(7/2) spectra were the C(3v)(111) in BaF2 crystals, C(4v)(100) in SrF2, and both cubic and tetragonal in CaF2. Author (TAB)

N71-14020# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Div.
HIGH VOLTAGE MICROSCOPY OBSERVATIONS OF DISLOCATIONS IN COBALT FERRITES
L. C. de Jonghe and W. L. Bell Mar. 1970 6 p refs Presented at the 7th Intern. Congr. on Electron Microscopy, Grenoble, France, 28 Aug. – 5 Sep. 1970
(Contract W-7405-eng-48)
(UCRL-19198) Avail: NTIS

As part of a study of phase transformations in cobalt ferrites, the nature of dislocations in cobalt ferrite spinels is reported. Author

N71-14021# Princeton Univ., N.J. Joseph Henry Labs.
NEUTRAL BRANCHING RATIOS OF THE ETA MESON
Malcolm T. Buttram, Michael N. Kreisler, and Richard E. Mischke Jul. 1970 12 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR
(Contract AT(30-1)-4159)
(PURC-4159-3; Conf;700806-28) Avail: NTIS

The neutral branching ratios of the eta meson were determined from the energy spectrum of single gamma rays in the eta center-of-mass. The sample of 7200 events after background subtraction yields (eta meson yields 3 pions(0))/(eta meson yields gamma gamma) = 0.82 + or – 0.05 and (eta meson yields pion(0) gamma gamma)/(eta meson yields gamma gamma) = 0.05 + or – 0.04 under the assumption that no other neutral decay modes contribute. The quoted errors include an estimate of possible systematic effects. Author (NSA)

N71-14022# Oak Ridge National Lab., Tenn.
THE CALCULATION OF THE RADIATION FIELD OF A DIRECTIONALLY RADIATING POINT SOURCE OF GAMMA-QUANTA WITH THE METHOD OF MOMENTS
F. W. Krueger Jul. 1970 18 p refs Transl. into ENGLISH from

Kernenergie. (West Berlin), v. 13 1970 p 47-54
(ORNL-TR-2330) Avail: NTIS

The extent to which the method of moments can be used for the determinstion of the field of radiation of a directionally radiating point source of gamma-quanta is investigated. For this purpose, a suitable computer program was worked out for the ZRA 1. As a test case the propagation of 1.28 MeV gamma-radiation (Co-60 radiation) in water was calculated. The experience gained thereby and the comparison of the calculated radiation field with the calculated or experimentally determined values of other authors show that the method applied is also suited for more extensive investigations. Author (NSA)

N71-14023# Illinois Univ., Urbana. Dept. of Physics.
PARTIAL WAVE ANALYSIS OF THE 3 PION DECAY OF THE A2
G. Ascoli, D. V. Brockway, H. B. Crawley, L. B. Eisenstein, R. W. Hanft et al Jun. 1970 13 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR Sponsored by AEC
(COO-1195-193; Conf-700806-21) Avail: NTIS

A new partial wave analysis is applied to the 3 pion decay of the A2(−) in the reaction pion(−) proton yields proton pion(+) pion(−) pion(−) at 5 and 7.5 GeV/c. The relative importance of the spin parities 0(−), 1(+), −(−), 2(+) and 2(−) are obtained as a function of 3 pion mass. Only the 2(+) spin parity shows resonant structure. Results are also given on the polarization and momentum transfer dependence of the A2 and on the mass dependence of the interference of 1(+) background with 2(+) resonance. Author (NSA)

N71-14024# Purdue Univ., Lafayette, Ind.
COHERENT Q-MESON PRODUCTION IN K(+)d INTERACTIONS AT 9 GeV/c
R. F. Holland, D. D. Carmony, H. W. Clopp, D. Cords, A. F. Garfinkel et al [1969] 8 p ref Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR Sponsored by AEC
(COO-1428-226; Conf-700806-31) Avail: NTIS

Results are presented on the production and decays of kaon pion pion enhancements in the Q region. The analysis is based on roughly 40,000 three- and four-prong events measured in an exposure of 150,000 pictures (7 events/ microbarn) in the Brookhaven 80 in deuterium bubble chamber. The pertinent reactions are kaon(+) deuteron yields Q meson deuteron, and kaon(+) dueteron yields Q meson proton neutron where Q meson yields kaon (+) pion(+)pion(−). Author (NSA)

N71-14025# Oak Ridge National Lab., Tenn.
THE LOW-ENERGY NEUTRON SPECTRUM OF THE ORNL TOWER SHIELDING REACTOR BEAM
R. M. Freestone, Jr., F. J. Muckenthaler, K. M. Henry, Jr., and C. E. Clifford 24 Aug. 1970 7 p refs
(ORNL-TM-3098) Avail: NTIS

An estimate of the spectrum of neutrons having energies between 0.4 and 1.5 MeV emitted by the ORNL Tower Shielding Reactor (TSR-2) has been made. Spherical, hydrogen-filled proportional counters were used to obtain the data. The unfolded result of the measurement is presented as a histogram of flux vs energy. Author (NSA)

N71-14034* Oak Ridge National Lab., Tenn. Neutron Physics Div.
TABULATED CROSS SECTIONS FOR HYDROGEN AND HELIUM PARTICLES PRODUCED BY 62 MeV AND 29 MeV PROTONS ON Sn 120
F. E. Bertrand (Univ. of Southern Calif.) and R. W. Peelle Jul. 1970 60 p refs
(NASA ORDER L-12188; Contract W-7405-eng-26)
(NASA-CR-111729; ORNL-4471) Avail: NTIS CSCL 20H

Tabulated differential cross sections are presented for the production spectra of proton, deuteron, triton, helium-3, and alpha particles from Sn-120 bombarded by 62- and 29-MeV protons. Continuum cross sections in approximately 1-MeV bins are tiellbd for 19 angles for 62-MeV incident protons, and for 5 angles for 29-MeV protons. The low-energy cutoffs range from 2 to 6 MeV for the different exit particle types. Angular distributions are given for excitation by 62-MeV protons, of states at 0, 1.17, and 2.38 MeV in Sn-120; and at 0, 0.73, 1.02, and 1.29 MeV in Sn-119. Only the elastic scattering cross sections are given for incident 29-MeV protons, since there is an inadequate amount of data for angular distributions. Author (NSA)

N71-14058# California Univ., Berkeley. Lawrence Radiation Lab.
SYNCHROTRON RADIATION AND RING FORMATION IN THE ELECTRON RING ACCELERATOR
C. Pellegrini 13 May 1970 14 p refs Presented at 2d Natl. Conf. on Particle Accelerators, Moscow
(Contract W-7405-eng-48)
(UCRL-19815; Conf-700908-1)Avail: NTIS

The possibility is discussed of using synchrotron radiation to form electron rings having a very high electric field to hold the ions inside the ring. The formulas describing how the energy and the dimension of the ring change under the effect of synchrotron radiation are derived, and a numerical example is given. Author (NSA)

N71-14060# Purdue Univ., Lafayette, Ind.
PROPOSAL FOR AN EXPOSURE OF THE 18 FOOT DEUTERIUM FILLED BUBBLE CHAMBER TO A BEAM OF SEPARATED POSITIVE PIONS AT 40 GeV/c AT NAL
21 Jul. 1970 8 p refs Sponsored by AEC
(COO-1428-230) Avail: NTIS

Production mechanisms and properties of reactions are studied where there are an even number of visible pions and a visible nucleon in the final state. These reactions are used to obtain information on: G parity of high mass bosons, study of the multiperipheral chain in pion pion scattering a la Amati-Fubini-Stanghellini and Chew-Goldberger-Low, study of the properties of Pomeron exchange in pion pion scattering, test of the vector dominance model, spin parity determination of higher boson resonances, and a search for unexpected new phenomena. Concurrently a hybrid system is proposed. It is essential to understand the origin of possible biases in such a system. Since no experimental results exist in the 40 GeV region, which has bearing on the pion pion nucleon final state, it is essential to carry out a large statistics bias free inelastic pion nucleon scattering experiment. It is of interest to all counter and spark chamber groups who intend to study the pion pion nucleon final state. A seperated positive pion beam and a deuterium filled chamber are requested. On the order of 600,000 pictures are needed to obtain reasonable statistics, although this quantity may need modification depending on possible collaboration with other groups who have a comparable scanning or measuring facility. Author (NSA)

N71-14074# Michigan Univ., Ann Arbor. Great Lakes Research Div.
NONDESTRUCTIVE ACTIVATION ANALYSIS OF ENVIRONMENTAL SAMPLES
Richard Dams and John A. Robbins May 1970 101 p refs
(Contract AT(11-1)-1706)
(COO-1706-8; Rept-48) Avail: NTIS

The general principle of activation analysis is discussed, along with the procedure for nondestructive activation analysis of environmental samples, including apparatus, identification of isotopes-qualitative analysis, quantitative analysis of Ge(Li) spectra.

irradiation-counting scheme, sensitivity-detection limits, possible interferences, and neutron flux mapping. Special attention is given to computerized data reduction, including tape analysis, data analysis programs, base spectrum calculation and peak integration, plotting, peak search routing, component identification, nonlinear least squares program, and composite program. No specific analyses are described. NSA

N71-14083# Oak Ridge National Lab., Tenn. Isotopes Development Center.
OBSERVATION OF NEW HIGH ENERGY GAMMAS OF IODINE 132 [SUR L'OBSERVATION DE NOUVEAUX GAMMAS DE HAUTE ENERGIE DE L'IODE 132]
Gerard Ardisson et al Jan. 1970 5 p refs Transl. into ENGLISH from Compt. Rend., Ser. A, B (Paris), no. 268 1969 p 96–99
(ORNL-tr-2263) Avail: NTIS

The gamma radiation of I-132 formed from Te-132, has been studied at high energy with the help of a pair spectrometer in which a n-i-p diode of Ge(Li) is the main detector. The higher resolution has permitted observation of 12 new gamma rays. Author (NSA)

N71-14084# California Univ., Livermore. Lawrence Radiation Lab.
THE LIVERMORE FISSION FRAGMENT ANALYZER
P. C. Stevenson, J. T. Larsen, and J. J. Leary 13 Aug. 1970 11 p refs Presented at Conf. on the Properties of Nuclei Far from the Region of Beta-Stability, Leysin, Switzerland, 31 Aug.–4 Sep. 1970 Sponsored by AEC
(UCRL-72422; Conf-700815-1) Avail: NTIS

A technique has been developed for separating ions formed in gases in times of less than 100 msec by mass analysis. The method may be applied to any chemically stable ionized species. Separations between adjacent masses are good. Transmission is comparable to that of existing one on-line isotope separators. Thick and extended sources of ions may be used without degrading the performance of the device. The technique should be applicable to ionized products of nuclear reactions, such as fission, which have sufficient recoil momentum to carry them into the gases. Author (NSA)

N71-14104# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FAST REACTOR FUEL INTERACTION WITH A CONCRETE FLOOR AFTER A HYPOTHETICAL CORE MELTDOWN
G. Jansen 8 Jan. 1970 41 p refs
(Contract AT(45-1)-1830)
(BNWL-CC-2369) Avail: NTIS

The results of preliminary calculations of the penetration by core material from the Fast Flux Test Facility (FFTF) into a concrete floor made with basalt aggregates are presented. The fission product heat generation rate and the basic assumptions used in the chemical and heat transfer calculations are described. The mechanical integrity of the concrete and the behavior of the moisture in the concrete are then discussed. The melting ranges of molten concrete components and the available data on the solubility of fuel compounds in the molten concrete are evaluated prior to the consideration of fuel-concrete interactions during pool formation. The size of the molten pool is then estimated as a function of heat transfer rates, pool shape, and whether upward heat transfer is impeded by crust formation. NSA

N71-14105# Oak Ridge National Lab., Tenn.
PRELIMINARY CALCULATIONS OF THE HYDROCYCLONE CONTRACTOR TYPE MPH
P. M. Hoffmann [1970] 19 p Transl. into ENGLISH of Inst. of Nucl. Res., Warsaw, report INR-1068
(ORNL-tr-2358; INR-1068) Avail: NTIS

The necessity of reprocessing highly burned up nuclear fuels requires new technological solutions. This problem can be solved by minimizing the time of contact between the aqueous and organic phases in the solvent extraction process. Centrifugal contactors allow the time of contact to be reduced by 2 to 3 orders of magnitude. Theoretical considerations concerning a centrifugal extractor of the type mixer–pump–hydrocyclone in which the time of contact between the phases is about 4 sec and the efficiency of 1 l/min, are given. Author (NSA)

N71-14106# Massachusetts Univ., Amherst.
STUDY OF Y*(1385) pion PRODUCTION NEAR THE Y*(1520) RESONANCE
Shu-bon Chan, J. Button-Shafer, S. S. Hertzbach, R. R. Kofler, G. W. Meisner et al Apr. 1970 5 p refs Presented at Intern. Conf. on Hyperon Resonances, Durham, N.C.
(NYO-3651-13; Conf-700416-6) Avail: NTIS

The production of sigma hyperon(1385) in kaon(−) plus proton yields lambda hyperon plus pion(+) plus pion (−) interactions at 375 and 415 MeV/c was studied near the lambda hyperon(1520). The purpose of the experiment was to determine to what extent the production of sigma hyperon(1385) derives from the lambda hyperon(1520) decay. NSA

N71-14108# California Univ., Livermore. Lawrence Radiation Lab.
DECAY OF Lu-170 TO Yb-170 [RASPAD Lu-170 K Yb-170]
N. Bonch-Osmolovskaya et al May 1970 45 p refs Transl. into ENGLISH of Joint Inst. for Nucl. Res., report JINR-P6-4773
(UCRL-Trans-10467; JINR-P6-4773) Avail: NTIS

The Lu-170 yields Ub-170 decay was investigated by measuring the single gamma-spectrum and by using the coincidence technique. Based on this, the decay scheme was constructed and analyzed. The experimental results are compared with theoretical calculations. Author (NSA)

N71-14110# Oak Ridge National Lab., Tenn.
CORRELATIONAL METHOD OF STUDYING PLASMA INSTABILITIES IN THE TOKAMAK-3 APPARATUS
S. V. Mirnov et al [1970] 20 p refs Transl into ENGLISH of Russian report IAE-1907
(ORNL-tr-2352; IAE-1907) Avail: NTIS

Correlation measurements of the spatial fluctuations of the magnetic fields of the discharge current in the Tokamak-3 device are presented. A system of 18 magnetic probes located on the external surface of the discharge chamber were used as the detectors. The subtraction of their readings by means of a balance scheme with subsequent squaring and averaging made it possible to obtain the signal proportional to 1−f(Phi,Psi), at any given time, where f = correlation function of the fluctuations of the magnetic fields, and Phi and Psi = toroidal angular coordinates. The results of the corresponding measurements are presented for several discharge systems in the Tokamak-3 apparatus. With the assumption that the observed fluctuations are related to rotation of the plasma having a nonuniform current density distribution in the vicinity of the boundary, it is possible to link their origin to the development of hydromagnetic instabilities of the highest mode. Author (NSA)

N71-14111# Atomic Energy Commission, New York. Health and Safety Lab.
TESTS OF TLD-700 HIGH SENSITIVITY LiF RIBBON FOR LOW-LEVEL ENVIRONMENTAL RADIATION MEASUREMENTS
Arthur Shambon and Donald C. Freeswick Jul. 1970 15 p refs
(HASL-233) Avail: NTIS

A technique for measurement of gamma dose down to 1.5 mR with a standard deviation of 10% for individual dosimeters is described. Lithium fluoride thermoluminescent ribbons are used with an improved readout system called the HASL luminescence emission monitor (LEM). The LEM employs nitrogen gas heating and an ellipsoidal reflector for light collection. Sensitivity data are presented. NSA

N71-14112# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

TIMH: A COMPUTER PROGRAM FOR THE DETERMINATION OF FLUENCE WITH A TIME-VARYING FLUX

R. D. Bourquin Aug. 1970 31 p refs
(Contract AT(45-1)-1830)
(BNWL-1492) Avail: NTIS

A method is described for calculating flux and fluence from activities induced in neutron-activated foils from irradiations with varying reactor power. The FORTRAN 5 program that performs calculations according to this method is described, along with input instructions, a complete listing, and an illustrative test case. Author (NSA)

N71-14123# California Univ., Livermore. Lawrence Radiation Lab.

DELTA AND EPSILON THERMAL EXPANSION COEFFICIENTS AND THE DELTA-TO-EPSILON CONTRACTION FOR SOME PLUTONIUM-RICH ALLOYS

Alfred Goldberg, Robert L. Rose, and David K. Matlock (Stanford Univ.) 17 Jun. 1970 18 p refs Presented at 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex., 5-9 Oct. 1970 Sponsored by AEC
(UCRL-72223; Conf-701001-2) Avail: NTIS

Linear thermal expansion coefficients of the delta and epsilon phases and the delta yields epsilon transition contraction were obtained by dilatometry for Pu and a series of Pu–Ga, Pu–Al and Pu–Ce alloys. The expansion coefficients of the delta phase were plotted as a function of solute content and electron/atom concentration. The results are consistent with an electronic model that allows interband transitions to occur between the 5f band and the conduction band(s) during changes in both solute concentration and temperature. The expansion behavior of the epsilon phase for the different compositions was observed to be typical of many metals. The delta yields epsilon contraction generally decreased with an increase in solute concentration. This was attributed to the relative extent to which the behavior of the delta and epsilon phases departed from that expected for a normal metal. The correlations obtained for the Pu–Ga and Pu–Al series were similar in the three regions, but some variations from these results were obtained in the Pu–Ce series. Author (NSA)

N71-14131# Bettis Atomic Power Lab., Pittsburgh, Pa.

TWO-OVERLAPPING GROUP-TRANSPORT APPROXIMATION FOR THERMAC NEUTRON PROBLEMS

M. Natelson and E. M. Gelbard May 1970 19 p refs Presented at the Summer Meeting of Am. Nucl. Soc., Los Angeles, 28 Jun.–2 Jul. 1970
(Contract (AT(11-1)-GEN-14)
(WAPD-T-2341) Avail: NTIS

An approximate method for solving the energy-dependent thermal neutron transport equation in X-Y geometry is given. Two variants of this method have been developed. In the first variant the flux over the whole thermal energy range is treated by the overlapping group technique. The trial function is of a form involving two space-angle functions each multiplied by a trial spectrum. The space-angle functions are computed by solving two coupled transport equations, using S sub N or P sub N methods. Numerical experiments show that this first approach is not always adequate and that a more complicated, second variant must, sometimes, be used instead. In this second variant the thermal range is split into two bands. The upper band is treated as one neutron group, while the two-overlapping group method is applied in the lower band. Experience indicates that, even when the first method is inadequate, the second is accurate enough for most analysis work. Author (NSA)

N71-14138# Wisconsin Univ., Madison.

NMR STUDIES FOR A DIFFUSION ACTIVATED MECHANISM IN TLD IN LiF

Jerome Wagner and P. R. Moran 1969 3 p refs
(Contract AT(11-1)-1105)
(COO-1105-157) Avail: NTIS

Systematic NMR measurements were carried out over a wide temperature range in thermoluminescent lithium fluoride samples in an attempt to correlate the NMR properties and the body diffusion of defect states in lithium fluoride. It is concluded that there is no correlation between the NMR measured diffusion activation energies and the thermoluminescence activation energies. NSA

N71-14150# University of Southern Calif., Los Angeles. Dept. of Chemistry.

ON THE MANY BODY THEORY OF THE ELASTIC SCATTERING OF ELECTRONS FROM ATOMS AND MOLECULES

Barry Schneider, Howard S. Taylor, and Robert Yaris (Wash. Univ., St. Louis, Mo.) [1969] 40 p refs Supported in part by Alfred P. Sloan Found.
(Grant NSF GP-7861)
Avail: Issuing Activity

A method for the calculation of the elastic scattering of electrons from atoms and molecules is presented using the many body Green's function techniques of Martin and Schwinger. The procedure involves the self-consistent solution of a pair of equations: one for the one-particle Green's function and the other for the response function of the target in the time dependent HF approximation (Random Phase Approximation). That both of these equations are one dimensional is a great computational advantage over more conventional techniques. The physical nature of our approximation and a numerical scheme to implement our theoretical discussion are reviewed. Author

N71-14176# Purdue Univ., Lafayette, Ind.

TWIN MESON PRODUCTION IN K(–)d REACTIONS

A. F. Garfinkel, A. C. Ammann, D. D. Carmony, and W. L. Yen [1970] 14 p refs Sponsored in part by AEC
(COO-1428-227) Avail: NTIS

A new interpretation of published data on the reaction K(–)n yields lambda(0) hyperon twin meson(–) is made which appears to make it compatible with a J sub PC = 2(++) assignment for the twin meson(–) and hence with the simple quark model. New data on the reactions K(–)n yields Lambda(1°, hyperon twin meson(–) and K(–)n Sigma(0) hyperon twin meson(–) are presented which are compatible with J sup PC = 2(++) for the twin meson(–). In for the twin meson (–). In addition, it appears that the twin meson(–) produced by kaons is narrow and has different branching ratios from the state throughly studied in pion induced reactions. Author (NSA)

N71-14177# Purdue Univ., Lafayette, Ind.

K(496), K°(896), AND K°°(1420) PRODUCTION IN K(+)n INTERACTIONS AT 8.0 GeV/c

H. W. Clopp, D. D. Carmony, D. Cords, R. L. Lander (Calif. Univ.,

Davis). F. J. Loeffler et al. [1970] 11 p Presented at 15th Intern. Conf. on High Energy Phys., Kiev Sponsored by AEC
(COO-1428-229; Conf-700806-30) Avail: NTIS

From a 150,000 picture K(+)d exposure at 9.0 GeV/c in the BNL 80 inch bubble changer, 40,000 three- and four-prong events, 8,000 events of the one- to four-prong plus vee topology and several thousand selected two prongs were measured. The reaction K(+)n yields pK(+) pion(−) is discussed including K* (890) production and decay. The observed proton pion low-mass enhancement is discussed in terms of a double Regge exchange model. Author (NSA)

N71-14186# Oak Ridge National Lab., Tenn. Isotopes Div.
CHEMICAL RECOVERY AND REFINEMENT PROCEDURES IN THE ELECTROMAGNETIC SEPARATION OF ISOTOPES
W. C. Davis Aug. 1970 108 p refs
(Contract W-7405-eng-26)
(ORNL-4583) Avail: NTIS

Specific procedures for the recovery and refinement of electromagnetically separated isotopes are given. Appendices on health and safety hazards, removal of impurities, and special preparations from inventory forms of isotopes are included. NSA

N71-14187# Argonne National Lab., Ill. Reactor Engineering Div.
INELASTIC RESPONSE OF PRIMARY REACTOR CONTAINMENT TO HIGH-ENERGY EXCURSIONS
Gabriel Cinelli, Jr., Joseph Gvildys, and Stanley H. Fistedis Nov. 1969 69 p refs
(Contract W-31-109-eng-38)
(ANL-7499) Avail: NTIS

The inelastic response of primary containment to a high-energy axisymmetric excursion is found by numerical techniques. First, the equation of state for inelastic behavior is discussed. Then the basic conservation laws of mass, momentum, and energy are given in Eulerian coordinates. These equations are then transformed into Lagrangian coordinates and the finite-difference equations for numerical computation. Finally, the results of a sample problem calculation are given. Author (NSA)

N71-14189# Brookhaven National Lab., Upton, N.Y.
ROOM TEMPERATURE LONG-PULSE RF BEAM SEPARATORS
H. N. Brown, H. Hahn, H. J. Halama, D. M. Lazarus, and J. Sandweiss 15 Jul. 1970 42 p refs Sponsored by AEC
(BNL-14974) Avail: NTIS

The production of purified beams of elementary particles in the momentum range from 5 to 15 GeV/c suitable for counter spark-chamber experiments at the Brookhaven AGS is discussed. Two general methods have been considered: (1) use of a chain of sixteen conventional iris-loaded deflectors, and (2) the major aspect of this report, the use of a long dielectric-loaded deflector. The need for a strong magnetic focusing channel around the deflector and its effect on the particle motion is discussed. A specific beam optical system from target to beam stopper with a solid angle close to .0006 sr is suggested, and the expected separated particle fluxes are calculated. The deflecting properties of a rectangular waveguide loaded symmetrically with BeO are discussed, and the required tolerances are determined. A microwave system for the long-pulse separator is presented in detail sufficient for a budgetary cost estimate. Author (NSA)

N71-14201# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF A MULTIELEMENT REGENERATIVE EXTRACTION SYSTEM FOR THE BERKELEY 184-INCH CYCLOTRON
Arthur C. Paul May 1970 18 p refs
(Contract W-7405-eng-48)
(UCRL-19804) Avail: NTIS

Discussed is the matrix-method calculation of the properties of three element regenerative extraction system for a synchrocyclotron. It is shown that the three element system stability calculation can be conveniently parameterized in matrix formalism separating the perturbations strengths from the field geometry. Both linear and nonlinear perturbation can be employed with a computer code written to track particle vectors and calculate stability tables from the single-turn matrix for a multielement extraction system. The particle tracking includes simulation of the effect of acceleration during regeneration. Several extraction systems are considered and comparison is made with the results of numerical integration of the exact equations of motion in the measured magnetic field of the 184-inch cyclotron. Author (NSA)

N71-14202# Westinghouse Electric Corp., Philadelphia, Pa. Astronuclear Lab.
ANALYSIS OF U 235 RESONANCES FROM 62 eV TO 300 eV
D. W. Drawbaugh and G. W. Remley May 1970 166 p
(PB-193921; WANL-TME-2705) Avail: NTIS CSCL 20H

The single level Breit-Wigner formula was used for an analytical fit to U235 total, fission, and capture cross section data. The resonance energy, E sub O, the scattering width, Gamma sub n, the fission width, Gamma sub f, and the capture width Gamma, sub c, were calculated for resonances in the 62 eV to 300 eV energy range. Author (USGRDR)

N71-14203# Cambridge Univ. (England). Dept. of Physics.
RESEARCH ON THEORETICAL HIGH ENERGY PHYSICS AND QUANTUM THEORY OF ELEMENTARY PARTICLES Final Scientific Report
Richard J. Eden Jul. 1970 8 p refs
(Grant AF-EOAR-30-67)
(AD-712708; AFOSR-70-2459TR) Avail: NTIS CSCL 20/8

Theoretical research has been carried out in the following main areas in the theory of elementary particles: Strong interactions, especially in relation to self-consistency by the phase contour method relating high energy and low energy behaviour of collision amplitudes; Generalization of the Veneziano model, especially in relation to the inclusion of realistic particles with non-zero spin; Group theory and symmetries, especially in relation to kinematic singularities in amplitudes due to non-zero spin of colliding particles; S matrix theory; Weak interactions. Author (TAB)

N71-14204# Purdue Univ., Lafayette, Ind. Dept. of Physics.
OFF-ENERGY-SHELL T-MATRIX FOR LOCAL POTENTIALS WITH SINGULAR CORE INTERACTIONS. 2: TENSOR AND COULOMB FORCES
Y. E. Kim and A. Tubis [1970] 31 p refs Sponsored by AEC
(COO-1746-37) Avail: NTIS

A previous derivation of an integral equation, which gives the complete off-energy-shell t-matrix for two-body scattering via local potentials with singular core interactions, is generalized to include the effects of tensor and Coulomb forces. The core interaction is described by the boundary condition model (specified energy-independent logarithmic derivative of the radial wave function at the core radius). The formalism is now being applied to the calculation of tri-nucleon bound-state and scattering parameters using the Faddeev formalism and realistic nucleon-nucleon forces. Author (NSA)

N71-14205# Bureau of Mines, Washington, D.C.
THE RANGE IN METALS AND METAL OXIDE SYSTEMS

OF HEAVY IONS IN THE ENERGY RANGE 60 TO 400 KeV
B. D. Sartwell, P. B. Needham, Jr., and D. Danforth Jul. 1970 23 p refs
(PB-193986; RI-7416) Avail: NTIS CSCL 07D

Utilizing a theory developed by Lindhard for determining the range of low-energy ions in solids, the ranges of H, He, C, N, O, and Ar ions in Al2O3, Al, Fe2O3, Fe3O4, CuO, CU2O, Fe, Cu, Sn, and W were calculated for the energy range 60 to 400 kev using a computer program written in BASIC. The range, presented in graphical form, is given in both micrograms/sq cm and angstroms. In addition, heavy ion ranges were calculated for comparison with published experimental values. For ions with Z > 5, the discrepancy between the calculated values generally ranged from 2 to 40 percent; the largest deivations were probably due to experimental error. Author (USGRDR)

N71-14222# Wisconsin Univ., Madison. Dept. of Physics.
LOW TEMPERATURE THERMOLUMINESCENCE IN LiF
Ervin B. Podgorsak and John R. Cameron [1969] 19 p refs
(Contract AT(11-1)-1105)
(COO-1105-161) Avail: NTIS

The low-temperature thermoluminescence (TL) of LiF was investigated using irradiation at 78 K and heating to several hundred degrees centigrade. The supralinearity effect (TL/R increasing with exposure) was studied and found to depend on T(3). Optical repopulation experiments (X irradiation at room temperature, heating to approximately 200 C to empty all TL traps, cooling to 77 K, and illumination with F-band light) were carried out to study the hole and electron traps of different glow peaks. NSA

N71-14223# Oak Ridge National Lab., Tenn.
IONIZATION IN THE INTERIOR OF A SATELLITE BY BREMSSTRAHLUNG PRODUCED BY THE ELECTRON COMPONENT OF VAN ALLEN RADIATION
R. Baeuerlein [1970] 27 p refs Transl. into ENGLISH of Bundesmin. fuer Wiss. Forsch., report BMWE-FB-W-69-04
(ORNL-tr-2202; BMwF-Fb-W-69-04) Avail: NTIS

A method is described for determining the ionization occuring in a silicon component behind a shield of given mass thickness due to the bremsstrahlung produced in the outer skin of a satellite by the electron component of the Van Allen radiation. With a typical electron spectrum, the ionization due to the bremsstrahlung is generated predominantly by low-energy electrons. Compared with the ionization due to direct radiation, the ionization in the inner Van Allen belt due to bremsstrahlung is negligible, whereas in the range of the outer radiation belt it predominates from mass thickness of several g/sq cm onwards. Author (NSA)

N71-14224# Brown Univ., Providence, R.I. Dept. of Physics.
AN EIKONAL MODEL FOR LARGE-ANGLE np AND pp ELASTIC SCATTERING
H. M. Fried and K. Raman Jul. 1970 10 p refs Sponsored in part by AEC
(NYO-2262-TA-223) Avail: NTIS

An eikonal model is described for large-angle np and pp elastic scattering at medium energies. Each amplitude is parameterized as a sum of one-boson-exchanges modulated by the multiple virtual emission of soft neutral I = 0 and I = 1 vector mesons. Fits to the data are presented. Author (NSA)

N71-14231# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'Noi Fiziki.
ELASTIC KN SCATTERING AND CHARGE EXCHANGES WHEN BRANCHINGS ARE TAKEN INTO ACCOUNT
S. T. Sukhorukov 1969 20 p refs In RUSSIAN
(ITEF-754) Avail: AEC Depository Libraries

The analyses of the experimental data on K + or - N scattering and charge exchange reactions are carried out in the framework of the complex angular momentum method. The branch points in j-plane are taken into account. Their contributions to the amplitudes of the processes are parameterized in a simple form which corresponds to the optical model of the successive rescatterings. Good agreement with the experiment is achieved in the region of the small momentum transfer. Author (NSA)

N71-14232# Tokyo Univ. (Japan). Working Group for Construction of Proton Synchrotron.
CALORIMETRIC DETERMINATION OF ABSORBED DOSE RATE OF EPOXY RESIN IRRADIATED IN JPR-4
Suoh Sakata (Natl. Inst. of Radiol. Sci.), Tetsuo Inada (Natl. Inst. of Radiol. Sci.), Tadayoshi Doke, Noboru Moriyama (Japan Atomic Energy Res. Inst.), and Kazuaki Ketoh (Japan Atomic Energy Res. Inst.) Jun. 1970 19 p refs Presented at the Conf. on Absolute Determination of Radiation Dose and Absorbed Dose Standard, Riso, Denmark, 25-29 May 1970
(SJC-A-70-4; Conf-700529-1) Avail: AEC Depository Libraries

For the purpose of measuring the absorbed dose of the specimen irradiated by some high dose rate radiations such as radiations in a nuclear reactor, two sets of adiabatic type calorimeters were designed, manufactured, and used. One is of the absorber of epoxy resin, and the other is of graphite; the latter is needed to separate the dose of epoxy resin into that due to gamma-rays and that due to neutrons. The calorimeters were hung down into a vertical experimental pipe tentatively called K-pipe for the present. Measurements were made at reactor power of from 0.05 to 2.5 MW, to clarify the correlation between the specimen's dose and the reactor's power. Dependency of the dose rate on the location of the specimen in the pipe was examined only at 2.5 MW, since the relative contribution of neutrons and gamma-rays to the total dose seems almost constant unless the reactor power is very low. Calibration of the calorimeters, namely the conversion of the voltage increase of the meter to the absorbed dose rate, was made with a known gamma-ray field. Author (NSA)

N71-14235# Institute of Nuclear Research, Warsaw (Poland).
A RIG FOR THE MEASUREMENTS OF THE TEMPERATURE DEPENDENT CHARACTERISTICS OF THE RJ-200 IONIZATION CHAMBERS
A. Yanikovskii and Ya Kot 1970 16 p refs In RUSSIAN
(INR-1184) Avail: AEC Depository Libraries

This report summarizes the first stage of the realization of the program concerning the neutron detector properties investigation in the temperature range up to 500 C. The description of the laboratory stand for measurements of the temperature effects on RJ-200 ionization chamber characteristics is presented. Also the measured results of the heat transfer and temperature distribution in this experimental facility are discussed. Author (NSA)

N71-14243# Los Alamos Scientific Lab., N.Mex.
METHOD OF COMPUTING FLUID MOTION IN TWO-DIMENSIONAL CARTESIAN OR CYLINDRICAL COORDINATES BY FOLLOWING LAGRANGIAN ENERGY CELLS
Patrick J. Blewett May 1970 10 p
(Contract W-7405-eng-36)
(LA-4464) Avail: NTIS

It is conjectured that for some physical flow problems there may be an advantage in following energy exactly as one follows mass elements in the conventional Lagrangian formulation of fluid dynamics. The argument generalized to a two dimensional idea of Enig who derived the equations for one dimensional slab geometry is examined. The equations are derived both differentially and integrally from the Eulerian form, and they are compared with the conventional Lagrangian equations. Author

N71-14244# European Organization for Nuclear Research, Geneva (Switzerland).
PROBLEMS OF CONTROLLING ACCELERATORS BY DIGITAL COMPUTERS
N. I. Andryushchenko-Lyutsenko et al Apr. 1970 7 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Moscow, report NTD-6821
(CERN-Trans-70-5; NTD-6821) Avail: AEC Depository Libraries

Basic problems of proton synchrotron control being solved by computers are considered, including those of monitoring of accelerator systems, automatic control and optimization of operating modes, and generation of programmed control signals on the basis of information derived from the accelerated beam. Author (NSA)

N71-14245# Kernforschungszentrum, Karlsruhe (West Germany).
STABILITY OF A BEAM STANDING IN INFERIOR QUALITY IN RECIPROCAL ACTION WITH A RESONATOR [UEBER DIE STABILITAET EINES MIT EINEM RESONATOR GERINGER GUETE IN WECHSELWIRKUNG STEHENDEN STRAHLS]
Ya. S. Derbenev et al [1970] 11 p refs Transl. into GERMAN of Akad. Nauk SSSR, Novosibirsk, preprint No. 326 In GERMAN
(TFK-tr-319) Avail: AEC Depository Libraries

The coherent transverse stability of a short beam which is in interaction with a low-quality resonator was investigated. It is shown that this interaction can lead to the so-called instabilities without memory. Author (NSA)

N71-14246# International Centre for Theoretic Physics, Trieste (Italy).
INVESTIGATION OF SOME DUAL AMPLITUDES WITH CUTS
Muhsin A. R. Abo-Shaeer Jul. 1970 16 p refs Submitted for publication Supported by IAEA and UNESCO
(IC-70/89) Avail: AEC Depository Libraries

Two simple ways of adding an infinite number of direct channel two-particle thresholds to the Veneziano picture, which usually contains only resonances in the direct channel, are studied. The high-energy behavior, positivity, and one plane structure of the resulting amplitudes, which turn out to have Regge cuts in addition to Regge poles in the crossed channel, are investigated. Authors (NSA)

N71-14247# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
SEARCH FOR SUPER-HEAVY ELEMENTS IN NATURE: BASES AND PERSPECTIVES
G. N. Flerov and S. A. Karamyan 1970 36 p refs In RUSSIAN Presented at the Inzrn. Mendeleev Congr., Turin, Sep. 1969
(JINR-P6-4902; Conf-690945-1) Avail: AEC Depository Libraries

The existence of long-lived super-heavy elements in nature and their synthesis in stars are discussed. Theoretical predictions of physical and chemical properties of these elements were analyzed. Experimental results of the search for superheavy elements in nature and in cosmic rays are reviewed. The perspectives of development of experimental investigations in this direction are considered. Author (NSA)

N71-14253# International Centre for Theoretical Physics, Trieste (Italy).
ASYMPTOTIC SYMMETRIES AND HADRON SYSTEM
S. Oneda and Seisaku Matsuda (Polytechnic Inst. of Brooklyn) Jul. 1970 20 p refs Submitted for publication Supported in part by IAEA and UNESCO
(Grant NSF GP-8748)
(IC-70/76) Avail: AEC Depository Libraries

Formulation of an idea of asymptotic SU(3) and SU(2) symmetries which are compatible with the Gell-Mann-Okubo and the SU(2) mass splittings is discussed. Consequences of the application of these asymptotic symmetries so far obtained are briefly reviewed. Combined with the use of suitable equal-time commutation relations involving the generators of the groups and also their time derivatives, these asymptotic symmetries require that there exist rather simple SU(3) and SU(2) inter-multiplet regularities among the mass spectra of hadrons. Broken SU(3) and SU)2) sum rules obtained by using asymptotic symmetries exhibit simple but sometimes very significant modifications of exact-SU(3) and exact-SU(2) sum rules through the appearance of the physical masses and the mixing parameters in the sum rules. Author (NSA)

N71-14254# Bhabha Atomic Research Centre, Bombay (India). Electronics Div.
PANORAMIC EXPOSURE ASSEMBLY
P. S. Rao and U. C. Gupta 1970 8 p refs
(BARC-460) Avail: AEC Depository Libraries

A panoramic exposure assembly is designed and fabricated for accurate intercomparisons and routine calibration of dosimeters. The assembly consists of three systems: a pneumatic source positioning system, exposure timing system, and detector positioning system. A Ra source (9 mg), whose exposure rate was determined with the exposure standards set-up, is used for the calibration of detectors. The exposure intervals can be preset from a few seconds to 9999 secs. A number of dosimeters can be clamped in arc of 30 cm radius at a height of 6 feet above the ground level. The system is safe, automatic, and remotely controlled. It has a precision better than a fraction of a percent for intercomparisons and an accuracy better than + or − 3 percent for calibration of dosimeters. Author (NSA)

N71-14255# Puerto Rico Nuclear Center, Mayaguez.
HOT ATOM CHEMISTRY PROGRAM Progress Summary Report, Apr. 1969–Apr. 1970
Owen H. Wheeler, J. E. Trabal, M. L. McClin, H. Lopez Alonso, A. Vallejos et al Apr. 1970 7 p refs
(Contract AT(40-1)-1833)
(PRNC-139; PSR-5) Avail: NTIS

Progress is reported on a study of the mechanisms of Szilard-Chalmers processes in organic compounds containing direct multiple bonds between the heavy activated atom and carbon atoms of the organic radical. NSA

N71-14256# Bhabha Atomic Research Centre, Bombay (India). Technical Physics Div.
SURFACE BARRIER DETECTORS
Ramesh Chaudhry 1970 18 p refs
(BARC-456) Avail: AEC Depository Libraries

A large number of gold-silicon (n-type) surface barrier detectors have been fabricated with a very good yield. The technique adopted is described. Detectors have been made with more than 2 cm diameter and up to 0.5 mm depletion depth. Measurements made on the capacitance of these detectors and its variation with reverse bias are presented. Author (NSA)

N71-14257# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
CONTROL SYSTEM WITH LINEAR CALCULATOR FOR EXPERIMENTS IN NEUTRON SPECTROMETRY [UN SISTEMA DI CONTROLLO CON CALCOLATORE IN LINEA PER ESPERIENZE DI SPETTROMETRIA NEUTRONICA]
L. Babiloni, E. de Agostino, and G. Fillarini 12 Nov. 1969 19 p refs In ITALIAN
(RT/EL(69)12) Avail: AEC Depository Libraries

Software and hardware for a PDP-8 controlled triple axis neutron diffractometer are outlined. Author (NSA)

N71-14258# Institute of Nuclear Research, Warsaw (Poland).
PROPERTIES OF THE ELECTRON AND MUON COMPONENTS OF EXTENSIVE AIR SHOWERS FOR DIFFERENT MODELS OF HIGH ENERGY INTERACTIONS
Szczepan Karakula (Lodz Univ.) 1970 41 p refs
(INR-1162) Avail: AEC Depository Libraries

A theoretical analysis of the models of the development of extensive air showers based on the so-called CKP formula and a model based on the so-called isobar model was carried out. Various characteristics of extensive air showers and their fluctuations were calculated. NSA

N71-14259# Institute of Nuclear Physics, Krakow (Poland).
HIGH-ENERGY SCATTERING FROM NUCLEI
Wieslaw Czyz 1970 124 p refs
(INP-697) Avail: AEC Depository Libraries

The applicability to various collision processes of the diffractive multiple scattering model (Glauber model) is discussed with a special emphasis on nuclear high energy collisions. Author (NSA)

N71-14264# Sandia Corp., Albuquerque, N.Mex.
FLUSH-MOUNTED ELECTROSTATIC PROBE IN THE PRESENCE OF NEGATIVE IONS
K. J. Touryan and P. M. Chung (Illinois Univ., Chicago) Jul. 1970 38 p refs
(SC-RR-70-413) Avail: NTIS

To study the change in current voltage characteristics of a continuum flush electrostatic probe caused by the introduction of negative ions in the boundary layer by ablation surfaces during reentry, a simple flat plate flow analysis was made. The analysis shows that the negative ions affect the ambipolar region only. Two equations are obtained; one for positive ions and one for negative ions. The results show that the negative ions suppress the electron saturation current and increase the positive ion saturation current slightly. The effect of increasing the beta ratio for negative ions is to increase the positive saturation current slightly and further suppress the negative saturation current. The effect of varying the beta ratio for negative ions as well as the ion to electron temperature ratio is discussed in detail. It is concluded that, in general, when negative ions are present in the boundary layer in quantities greater than trace amounts, measurements by electrostatic probes alone cannot determine electron density concentrations. Author

N71-14265# International Centre for Theoretical Physics, Trieste (Italy).
MESON SPECTRUM FROM THE VENEZIANO MODEL AND OTHER CONSEQUENCES
C. S. Lam Jul. 1970 24 p refs
(IC-70/85) Avail: AEC Depository Libraries

A general formula is deduced for trajectory intercepts for the Veneziano model starting from the requirement of simple, unique and complete factorizability in every multiperipheral configuration. The formula resembles but does not coincide with similar ones of previous authors, and the reason for the difference is analyzed. If it is further required that the degeneracy of each trajectory be minimized and that the Hagedorn temperature is 170 MeV if the slopes of the trajectories are taken to be 0.9, then the formula forces some relations on the intercepts if the amplitude constructed is non-zero. This way either a mass relation is obtained or an extra selection rule over and above those usually adopted in strong interactions. Author (NSA)

N71-14266# International Centre for Theoretical Physics, Trieste (Italy).
BROKEN CHIRAL AND CONFORMAL SYMMETRY AND KUO TRANSFORMATION
A. M. Harun-Ar Rashid and M. A. Rashid Aug. 1970 17 p refs
(IC-70/91) Avail: AEC Depository Libraries

The breaking of conformal and chiral symmetry within the framework of effective Lagrangians is studied and it is shown that the (8,8) type of symmetry-breaking leads to unacceptable values of the pion-pion scattering lengths. A combination is then proposed, the particular form being uniquely fixed by the requirement of Kuo transformation. This is then shown to lead to improved scattering lengths for meson-meson scattering processes. Author

N71-14276# European Organization for Nuclear Research, Geneva (Switzerland).
ON SOME PROBLEMS OF THE AUTOMATIC CORRECTION OF BETATRON OSCILLATIONS IN CYCLIC ACCELERATORS
E. L. Burshtein et al Dec. 1969 5 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Moscow, report NTD-6818
(CERN-Trans-69-32; NTD-6818) Avail: AEC Depository Libraries

The equations for the moments of the particles are derived, and the beam dimension correction equation is studied, using as an example the suppression of parametric resonance. NSA

N71-14277# Kernforschungszentrum, Karlsruhe (West Germany).
ROLE OF THE ALPHA-RADIOACTIVE BACKGROUND IN THE INVESTIGATION OF THE DECAY OF ELEMENT 104 [UEBER DIE ROLLE DES ALPHA-RADIOAKTIVEN UNTERGRUNDES BEI DER UNTERSUCHUNG DES ELEMENTS 104]
G. N. Akapev et al 1969 9 p refs Transl. into GERMAN from Russian report JINR-P7-4772 In GERMAN
(KFK-tr-327; JINR-P7-4772) Avail: AEC Depository Libraries

The contribution of the Pb impurities to the alpha spectrum measured by Ghiorso et al. in the preparation of element 104 by the irradiation of Cf-249 targets with accelerated C-12 and C-13 ions was investigated by the irradiation of natural Pb targets with C-12 ions and a comparison of the two spectra. The results show that Pb impurities in the Cf-249 target are responsible for some intensive lines in the spectrum reported by Ghiorso. Well-known activities to be expected in the Ghiorso study were also not reported as being observed. An accurate critical analysis of the Ghiorso results is not possible because the experimental conditions were not reported. NSA

N71-14278# Kernforschungszentrum, Karlsruhe (West Germany).
NONLINEAR INTERACTIONS OF AN INTENSIVE BEAM OF CHARGED PARTICLES WITH THE ACCELERATING FIELD [NICHTLINEARE WECHSELWIRKUNG EINES INTENSIVEN STRAHLS GELADENER TEILCHEN MIT DEM BESCHLEUNIGUNGSFELD]
L. G. Lomize et al 1969 7 p refs Transl. into GERMAN from Russian report NTD-6910-R In GERMAN
(KFK-TR-318; NTD-6910-R) Avail: AEC Depository Libraries

The nonlinear interactions of an intensive beam of charged particles with the accelerating field were theoretically studied by the derivation of relations describing such interactions. The relations obtained were experimentally tested with an input operation of the I-100 injector of the Serpukhov synchrotron at a beam current of 80 ma and an initial equilibrium phase of 37 deg. The theoretical and experimental values for alpha (the ratio of the voltage drop on the basis of the beam charge to the initial voltage in the circuit) were compared. If the measurement errors of alpha and the formation of coherent oscillations in the accelerator are considered, then the agreement between theory and experiment can be considered satisfactory. NSA

N71-14279# European Organization for Nuclear Research, Geneva (Switzerland).
PHASE ACCEPTANCE OF QUADRUPOLE TRIPLETS IN TERMS OF MATRIX ELEMENTS
E. Regenstreif 24 Jul. 1970 73 p refs
(CERN-70-22) Avail: AEC Depository Libraries

Analytic expressions are derived to determine the phase space contour and area of a general triplet. It is shown that there are nine possible configurations for the phase space contour in the focusing-defocusing-focusing plane and four possible configurations for the phase space contour in the defovusing-focusing-defocusing plane. In all cases the acceptance areas can be obtained by means of relatively simple formulas involving easily calculable matrix elements. Extension of the theory to the quadruplet shows that there are nine possible configurations for the phase space contour in each plane of the quadruplet. The formulas giving the accepted areas were derived so that they can be used independently of the main body of the paper. Author (NSA)

N71-14283# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CPT AND INFINITE-COMPONENT FIELDS
A. I. Oksak 1970 32 p refs
(JINR-E2-5160) Avail: AEC Depository Libraries

Concepts are presented which are of use in the analysis of covariance of quantized fields with respect to the Poincare group involving the space-time reflection. There are fields (namely, infinite-component fields satisfying all the Wightman axioms) for which CPT-theorem fails; it is interesting therefore to search for relevant substitutes of the CPT-covariance. Author (NSA)

N71-14285# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
DUALITY DIAGRAM AND REGGE CUTS IN K(+) PHOTOPRODUCTION
A. Capella and J. Tran Thanh Van 5 Nov. 1970 16 p refs
Avail: NTIS

Data on Kaon(+) Lambda hyperon and kaon(+) Sigma hyperon(0) interactions from 5 to 16 GeV are discussed. It is shown that there is no dip present in kaon(+) photoproduction and the reasons for this are given. The considerations suggest a model consisting of an exchange degenerate kaon* - kaon** Regge contribution and its corresponding cut. The qualitative features of the model are described. Two different parameterizatioms are presented with one using the asymptotic behavior for the cut contribution and the other using a non-asymptotic behavior. D.L.G.

N71-14292# Kyoto Univ. (Japan). Research Inst. for Fundamental Inst.
ACAUSAL PION-NUCLEON TOTAL CROSS SECTIONS IN THE HIGH ENERGY REGION [AKAUSALE PION-NUKLEON TOTALEN QUERSCHNITTE IM HOCHENERGIEBEREICH]
Matsuo Sekine Oct. 1970 10 p refs In GERMAN
(RIFP-110) Avail: NTIS

The pion - nucleon total cross sections have been calculated using dispersion relation at high energy limit. If causality holds, obtained is sigma sub c(+) (infinite) = 1/2 (sigma (negative pion - proton) + sigma(positive pion-proton)) = 20.2 mb which is in disagreement with the recent Serpukhov measurement above 30 GeV, that is, sigma(+) (omega) = 24.0 plus or minus 0.2 mb. It is therefore argued that the constant value of the total cross section may be connected with causality violation in high energy regions. Author

N71-14293# Institute of Nuclear Research, Warsaw (Poland).
ALPHA ALPHA INTERACTION IN THE Be 9 YIELDS ALPHA ALPHA PROTON PION(-) DECAY
D. Chlebowska, J. Wrzecionko, and M. Zielinska-Pfabe 1970 7 p refs
(INR-P-1179) Avail: AEC Depository Libraries

The alpha particle energy distribution is calculated for the Be-9 yields alpha alpha proton pion(-) decay. The alpha alpha final-state interaction described by the Gaussian and Coulomb potential is treated exactly. The narrow peak at 0.095 MeV, which clearly corresponds to the ground state of Be-8, was obtained. Author (NSA)

N71-14294# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EXTENDED PARTICLE MODEL IN THE GENERAL THEORY OF RELATIVITY
M. A. Markov 1970 15 p refs
(JINR-E2-5271) Avail: AEC Depository Libraries

The Einstein-Maxwell field equations allow some specific solutions; these are almost closed Friedmann worlds, the metrics of which are connected with the Nordstrom-Reissner metric through a narrow throat. The classical parameters of this object, the sizes of the throat, its potential and the total mass of the system are given. These classical systems turn out to be unstable; the pair production effect in strong throat fields polarizes the initial charge of the system and classical systems with different initial charges tend to one and the same almost closed system, the so-called friedmon with microscopic values of the total charge, sizes, and the total mass. The system is viewed as the extended particle model in the general relativity theory. It can also be regarded as a specific example of a model with form factor in which the signal propagates with a velocity which is smaller than the velocity of light due to an appropriate change of the metric. In the Euclidean space the form factor leads, as a rule, to the appearance of superlight signals. Author (NSA)

N71-14309# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematick und Naturwissenschaften.
HANLE EFFECT MEASUREMENTS ON EVEN PARITY AND UNEVEN PARITY STATES IN THE YTTERBIUM 1-SPECTRUM [HANLE-EFFEKT MESSUNGEN AN ZUSTAENDEN GERADER UND UNGERADER PARITAET IM Yb 1-SPEKTRUM]
Joachim Luther (Ph.D. Thesis) 1970 41 p refs In GERMAN
Avail: NTIS

Hanle effect measurements were used to determine life times of several excited states in the ytterbium atom. Studies were performed on an ytterbium atomic beam that contained not only atoms of the 4f 14 6s2 1SO Yb I-ground level but also a vast number of metastable 4f 14 6s6p 3P2,0 levels. Also obtained were Hanle effect measurements on higher energetic states of even parity (that were not excitable from the ground level by electrical dipole radiation). Transl. by G.G.

N71-14310# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
COMMENTS ON INTERNAL SYMMETRIES IN DUAL MODELS
L. Gonzalez Mestres 4 Nov. 1970 13 p refs Sponsored by GIFT, Barcelona Univ.
Avail: NTIS

The uniqueness of the Chan-Paton SU(3) factor is shown for the dual Born terms involving nonexotic mesons only. The same method gives the uniqueness of the SU(2) factor for nonstrange nonexotic mesons, independently of SU(3). Uniqueness properties follow also for the KSV loops. Some remarks are made concerning factorization, nonet symmetry, charge conjugation, and the construction of realistic Veneziano-like amplitudes incorporating internal symmetries as well as kinematic factors. Author

N71-14313# Kernforschungszentrum, Karlsruhe (West Germany).
THE RADIOACTIVE PROPERTIES OF THE ISOTOPES OF ELEMENT 103
V. A. Druin 1969 7 p refs Transl. into GERMAN from Russian report JINR-P7-4755 In GERMAN
(KFK-tr-326; JINR-P7-4755) Avail: AEC Depository Libraries

The experimental results reported in 1961 on the radioactive properties of isotopes of Element 103 were in sharp opposition to experimental results obtained at Dubna. New experiments were made at Dubna to establish the properties of Element 103-255. The results showed that the origin of the alpha emitter reported with E sub alpha = 8.6 MeV and T sub 1/2 = 8 + or - 2 sec remains unexplained. The Dubna experiments for such an isotope of element 103 with these decay properties were negative. Isotopes were found at Dubna which must arise in the irradiation of Cf with B-10,11 isotopes, but which were not reported. The original identifications of the new alpha emitter as Element 103-257 was later repudiated by them and this activity was assigned to either Element 103-258 or Element 103-259 in contradiction to the experimental data reported. NSA

N71-14314# Brookhaven National Lab., Upton, N.Y.
DEPARTMENT OF APPLIED SCIENCE Annual Report
31 Dec. 1969 186 p refs
(BNL-50205) Avail: NTIS

Cladding effects on heat transfer to liquid metals are studied, along with rod displacement effects on heat transfer to liquid metals flowing through rod bundles. Two forced circulation stainless steel loops were used to test several heat resistant alloys for fuel cladding materials of advanced LMFBR. The National Neutron Cross Section Center is described, including compilation and evaluation activities, computer applications, and development of cross section theory. Potential hydroelectric, pumped storage power sources combined with nuclear power plant operations are analyzed. Activities of the nuclear materials, reactor physics, chemistry, radiation, and hot laboratory divisions are also reported. J.A.M.

N71-14315# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
CALCULATED NEUTRON FLUX SPECTRA IN SAMPLES IRRADIATED IN A TRAY ROD FACILITY OF THE NRU REACTOR
S. A. Kushneriuk Jan. 1970 68 p refs
(PB-192921; AECL-3519) Avail: NTIS CSCL20/8

Neutron flux spectra in the irradiation of milligram samples of plutonium and uranium oxide in a pneumatic facility of the NRU reactor are deduced, and effective U-235 and Pu-239 nuclide absorption and fission cross sections in the spectra are calculated. The values derived are compared with values obtained from a g+rs type analysis and with the values obtained by B. R. Leonard, R. C. Liikala and U. P. Jenquin of Battelle-Northwest in their independent consideration of the irradiation. Estimates of the uncertainties in the cross sections due to the uncertainties in the specification of the neutron spectrum for the irradiation are also given. Author (USGRDR)

N71-14316# Aktiebolaget Atomenergi, Studsvik (Sweden).
ANALYSIS OF PULSED SOURCE EXPERIMENTS PERFORMED IN COPPER-REFLECTED FAST ASSEMBLIES
Joergen Kockum Jun. 1970 31 p refs
(AE-398) Avail: AEC Depository Libraries

Pulsed source experiments performed in two copper-reflected fast assemblies have been analysed with a time-dependent S sub N code. It has been shown that no spectral equilibrium will be reached within the reflector due to the long slowing-down time in copper. A situation with a core and a reflector centered neutron population will develop but the interaction parameters will not be time-independent, making a two-region model only qualitatively valid. If the decay time of the core is longer than that of the reflector (which is shown to be the case for a soft spectrum core close to critical) it is shown to be approximately possible to use the point reactor model to determine a neutron lifetime. A better meeting ground for experiment and calculations is a direct calculation of the decay constant, which in this case was calculated to within 5% of the experimental value. The difference indicates a somewhat too soft calculated spectrum. The area method has been used to determine the reactivity in one of the assemblies. Author (NSA)

N71-14317# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
COMPARISON OF THE POINT AND SPACE KINETICS MODELS IN A URANIUM-HYDRIDE REACTOR [SOPOSTAVLENIE TOCHECHNOI I PROSTRANSTVENNOI MODELEI KINETIKI V URAN-GIDRIDNOM REAKTORE]
A. I. Mogilner, Z. Dimeshi, B. I. Kolosov, G. P. Krivolev, S. A. Morozov et al 1969 37 p refs In RUSSIAN
(FEI-177) Avail: AEC Depository Libraries

The point model of kinetics describes satisfactorily the experimental results in case of the periods commensurable with the reciprocal value of the basic constant for the decay of momentary neutrons. In case of the shorter periods (and accordingly at high frequencies), we observe in the statistical experiments a deviation from the point model. This corresponds to the fact that at short periods commensurable with the propagation time of a perturbation through the reactor's space, the latter ceases to behave as an integrated unit. The manifestation of the spatial effects is most perceptible in the experiments with a pulse-type neutron oscillator. The complexity of the statistical experiments precluded obtaining a high precision of the results. These experiments are described quite well within the scope of a two-point model by two decay constants. The calculations conducted for the attenuation decrements indicate that the measured values alpha sub 1 and alpha sub 2 can correspond to pertinent natural (eigen-) values. NSA

N71-14344# Washington Univ., Seattle.
THE PARITY FORBIDDEN DECAY OF THE 6.88 MeV O 16 STATE
E. M. Henley, T. E. Keliher, and D. U. L. Yu Apr. 1970 8 p refs Sponsored in part by AEC
(RLO-1388-569) Avail: NTIS

The decay rate of the 6.88 MeV state of O-16 is estimated with a parity-violating force involving rho-exchange. It is pointed out that this decay can be of crucial importance for testing part of the non-leptonic weak interaction. The reason is that isospin conservation in the alpha decay limits the interaction responsible for the parity mixing in the initial state of the Delta I = 0 parity-violating force. This force arises from the strangeness nonchanging nonleptonic weak currents. Pion exchange only contributes to the decay through radiative corrections. Author (NSA)

N71-14345# Washington Univ., St. Louis, Mo.
SUMMARY REPORT ON CYCLOTRON UTILIZATION, OPERATIONAL ACHIEVEMENTS, AND IMPROVEMENTS
Technical Progress Report, Period Ending 31 May 1970
Franklin B. Shull 15 Jul. 1970 24 p
(Contract AT(11-1)-1760)
(COO-1760-3) Avail: NTIS

Operation and development of the cyclotron laboratory at Washington University, St. Louis, Missouri, are summarized. Cyclotron use and operational achievements are described. Particle energies and some maximum currents achievable are listed. NSA

N71-14346# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
RADIOACTIVITY CALIBRATION STANDARDS
W. B. Mann and S. B. Garfinkel Aug. 1970 125 p refs Presented at the Proc. of a Special Session of the Intern. Conf. of the Am. Nucl. Soc. Meeting on the Constructive Uses of Atomic Energy, Washington, D.C., 10–15 Nov. 1968
(PB-194364; NBS-SP-331) Avail: NTIS CSCL 18H

Experimental procedures and methods used in nine international radioactivity standardization laboratories are described by eight authors. The possibility of attaining accuracies of the order of 0.01% are discussed. The desirability of carrying out consistency checks of gamma-ray standards with time, using a gamma ionization chamber is emphasized. The validity of radioactivity standards is examined. International comparisons are discussed. An analogue method of liquid-scintillation counting is described. Certain types of radioactivity standards are critized. Author (USGRDR)

N71-14350# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
CONTINUUM PROCESSES INVOLVING ATOMIC SYSTEMS WITH CONFIGURATIONS 1s2...3pq
M. J. Conneely, Kenneth Smith, and Lester Lipsky [1969] 51 p refs Submitted for publication Supported by NSF
(Rept-69.266) Avail: Issuing Activity

The close-coupling approximation was used to compute cross sections for a wide range of processes (electron impact, photodetachment and photoionization) involving atomic systems with an incomplete outer 3(p)-subshell. The processes were chosen for their astrophysical interest. The purpose of the investigation is to provide a unified theoretical model for the wide variety of processes investigated and to compare the predictions of this close-coupling approach with previous theoretical approximations and experiment. The principal conclusions are that these calculations are in reasonable agreement with observed photoionization cross sections where available, but differ somewhat from previous calculations. Of particular interest is the predicted absence of an expected resonance series in both the 1S-e and 1D-e partial wave contributions to the photoionization of sulphur as well as the absence of shape resonances in Si and P analogous to those recently reported in carbon and nitrogen. Author

N71-14351# University of Southern Calif., Los Angeles. Dept. of Chemistry.
MODELS, INTERPREATIONS AND CALCULATIONS CONCERNING RESONANT ELECTRON SCATTERING PROCESSES IN ATOMS AND MOLECULES
Howard S. Taylor [1969] 96 p refs Supported by NSF, Alfred P. Sloan Found., and Res. Corp.
Avail: Issuing Activity

The models of resonance states useful in predicting and interpreting results of experiments concerning electron scattering, autoionization, and resonant reactions in small atoms and molecules are reviewed. Models of single particle resonance, and core excited types are discussed with a heuristic approach to a stabilization method. Resonant scattering for the hydrogen molecule, and the helium atom is presented. F.O.S.

N71-14352# Grumman Aerospace Corp., Bethpage, N.Y. Fluid Mechanics Section.
ENERGY TRANSFER BETWEEN N2 AND ELECTRONICALLY EXCITED INERT GAS ATOMS AND IONS
T. T. Kassal and E. S. Fishburne Dec. 1970 22 p refs Submitted for publication
(RE-4005) Avail: NTIS

Collisions of the second kind between N2 and metastable inert gas atoms and ions have been studied in order to investigate the energy exchange mechanism. Excited inert gas atoms are created by means of an electron beam. The state of the nitrogen molecule immediately after the energy exchange is determined by examining the spectra produced by the excited nitrogen molecule. A nonthermal rotational excitation appears to accompany most of the electronic energy transfer processes. In the case of the reaction between Kr(+) and N2 the rotational excitation is limited to the N2(+)(B(2) Sigma U(+)) V=1 level. With the collision between a metastable argon atom and N2, the rotational excitation is limited to the v = 0 level of the N2(C+O 3rd power u-pi) state. The Franck–Condon factors for the change in vibrational levels during an electronic transition are not obeyed during either of these processes. Author

N71-14376# Illinois Univ., Urbana. Coordinated Science Lab.
A STUDY OF THE ENERGY AND ANGULAR DISTRIBUTIONS OF ELECTRONS SCATTERED FROM TUNGSTEN
Thomas Cooper Sep. 1970 176 p refs
(Contract DAAB 07-67-C-0199)
(AD-713056; R-491; UILU-ENG-70-236) Avail: NTIS CSCL 7/4

The purpose of this dissertation is to examine inelastic backscattering of low-energy (approximately equal or < 300 eV) electrons as a means of investigating solid surfaces. In the present work, the amount of information that can be obtained with a single experimental system has been increased by increasing the number of variable experimental parameters. Besides being able to vary the primary and secondary electron energies, one may also vary the direction for which scattered or secondary electrons are detected. TAB

N71-14377# Gulf General Atomic, San Diego, Calif.
HEAD-END SEPARATION OF BISO COATED FISSILE AND FERTILE PARTICLES FOR HIGH-TEMPERATURE GAS-COOLED REACTORS
S. Langer and H. R. Phillips Jun. 1970 21 p refs
(Contract AT(04-3)-167)
(GA-9888) Avail: NTIS

Studies were made on the separation of U-233 from U-235 based on the difference in stability of the oxide and carbide kernels. The fissile kernel containing U-235 is (U-235)C2 while the U-233 fissile kernel and the fertile kernels are (Th,U-233)O2 and ThO2. Results of fluid and static bed oxidation experiments indicate that irradiation of oxide microspheres produces changes in the kernels that impair their physical stability under oxidizing conditions. Studies on both irradiated and nonirradiated particles demonstrate that a differential leaching process could not successfully separate U-235 in a (U-235)3O8 ash from the U-233 in fragmented (Th,U-233)O2 kernels without an unacceptable isotopic mixing. NSA

N71-14378*# California Univ., Berkeley. Space Sciences Lab.
ENERGETIC PARTICLE FLUX EXPERIMENT (AIMP-D AND E) Final Report, 28 Jan. – 31 Oct. 1969
31 Oct. 1969 48 p refs *Its* Space Sci. Lab. Ser. 11, Issue 75
(Contract NAS5-9077)
(NASA-CR-115775) Avail: NTIS CSCL 20H

The scientific usage of the data from the University of California experiments aboard Explorers 33 and 35 (AIMP-1 and 2) is summarized. Basically, three major fields of study were pursued in the analysis of the data. These are energetic solar particles in the interplanetary medium, terrestrial particle fluxes in the magnetotail and magnetosheath-bow shock regions, and lunar effects on energetic particles. Much of the work on solar particle studies is based on comparisons with simultaneous observations on other spacecraft (IMP-3, OGO-1 and -3, OGO-5, IMP-4 and -5) as well as with ground-based optical and radio observations.

Studies of terrestrial fluxes have concentrated on the island fluxes, the distant magnetotail, and the magnetosheath and bow shock spikes which are observed as far as 60 Re upstream from the earth in the interplanetary medium. Author

N71-14379# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
LAMINAR COLLISION-FREE ELECTROSTATIC SHOCKS AND SHEATHS
Hans Persson Apr. 1969 64 p refs
(NP-18426; Rept-69-05) Avail: AEC Depository Libraries

Special Bernstein–Green–Kruskal solutions of the time-independent, one-dimensional, coupled Vlasov–Poisson equations were studied. The electrostatic potential was assumed to vary monotonically between two different, constant levels, and the ion and electron velocity distributions consistent with this potential were analyzed. The charge neutrality, overall pressure balance, and space charge (internal pressure balance) conditions impose conditions of Mach number type on the collision-free particle distributions. In particular, the Bohm criterion for wall sheaths was analyzed, and was found to apply in all cases when there are not enough particles of a given species reflected against the potential structure. Earlier work by Montgomery and Joyce is discussed, and it is shown that, under quite general conditions, the Mach number must exceed unity for small values of the potential. For arbitrary values of the potential, and for trapped electron distributions from a large class of functions, the Bohm criterion implies that the Mach number of the ions behind the shock must exceed a critical value. Author (NSA)

N71-14380# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
QUANTITIVE ANALYSIS OF MICROMETER-SIZE URANIUM ALLOY POWDERS USING THE ELECTRON MICROPROBE X-RAY ANALYZER
J. H. Stewart, Jr. 22 Sep. 1970 77 p refs Sponsored in part by AEC
(Y-1745) Avail: NTIS

The electron probe was used in the quantitative analysis of individual microparticle of uranium–molybdenum and uranium–niobium–zirconium alloys. A computer program was applied to correct the characteristic X-ray intensities of the alloyed metals excited by the electron beam for absorption, fluorescence, and atomic number effects. The accuracy of the method is comparable to that of the conventional chemical analysis of homogeneous bulk samples. A simplified specimen preparation and handling procedure was devised to prevent the usual rapid oxidation of the polished specimen surface, which would introduce a significant nonreproducible bias into the analysis. Author (NSA)

N71-14386# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
MEASUREMENTS OF CATHODE HEATING IN A PENNING DISCHARGE IN A STRONGLY INHOMOGENEOUS MAGNETIC MIRROR FIELD
N. Hopfgarten Feb. 1969 41 p refs
(NP-18416; Rept-69-01) Avail: AEC Depository Libraries

A technical description of the apparatus used for the measurements is described and a detailed description of a method for obtaining the results for the unsymmetric mode of burning is given, together with a discussion of the assumptions made. Mean ion densities in the range 10 to the 10th power to 10 to the 11th power/cu cm and mean ion energies between 1 and 5.5 keV were obtained. When the discharge was burning with one cathode on a high voltage and the other on a low voltage 60 to 70% of the current to the high-voltage cathode was carried by ions. The current of electrons to the low-voltage cathode was about 30 to 50% of the ion current. The current of electrons leaving this cathode depends strongly on the degree of asymmetry of the discharge. Author (NSA)

N71-14387# Institute of Nuclear Physics, Krakow (Poland).
NEUTRON DIFFRACTION STUDY OF GAMMA-FeOOH
Andrzej Oles, Andrzej Szytula, and Adam Wanic Feb. 1970 15 p refs
(PB-193217; INP-696/PS) Avail: NTIS CSCL 18H

The results of the study of gamma-FeOOH structure by means of neutron diffraction and Mossbauer method are discussed. The positions of the ions are determined. The hydrogen ion occupies a central position between two oxygen ions separated from one another by 2.70 A. The Neel temperature determined from magnetic susceptibility is 50K. An antiferromagnetic arrangement of the magnetic moments is suggested. Author (USGRDR)

N71-14388# Oak Ridge National Lab., Tenn.
THERMAL CONDUCTIVITIES OF Tm_2O_3, Yb_2O_3, AND A Tm_2O_3–Yb_2O_3 MIXTURE
E. E. Ketchen Aug. 1970 14 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3066) Avail: NTIS

The thermal conductivities of Tm_2O_3, Yb_2O_3 and a 46 mole % Yb_2O_3–54 mole % Tm_2O_3 mixture have been measured in a thermal comparator over a temperature range of 400 to 900 C. Author (NSA)

N71-14389# Columbia Univ., Irvington, N.Y. Nevis Labs.
EXPERIMENTAL MEASUREMENT OF THE CHARGE ASYMMETRY IN THE DECAY ETA MESON YIELDS PION(+) PION(−) PION(0)
Stephen Stein (Ph.D. Thesis) 1969 113 p refs
(Contract AT(30-1)-1932)
(NEVIS-177; CU-281; R-682) Avail: NTIS

The reaction eta-meson yields 3 pion was studied experimentally to determine whether or not a charge asymmetry exists. From a sample of 32,263 decays, an asymmetry of 1.66 + or − 0.63% was measured. The final 3-pion state, if C is not conserved, is consistent with a mixture of I = 1 and I = 2 states. If the matrix element is written as 1 + ay + bx, where x and y are Dalitz plot variables, the real part of b was determined to be 2.45 + or − 0.0075. Author (NSA)

N71-14390# Stanford Linear Accelerator Center, Calif.
BACKWARD PHOTOPRODUCTION OF NEUTRAL PIONS AT 6 TO 18 GeV
Donald H. Tompkins Jul. 1970 105 p refs
(Contract AT(04-3)-515)
(SLAC-109) Avail: NTIS

Differential cross sections for neutral pion photoproduction at backward angles were measured in the momentum transfer range u = 0 to −1 GeV/c squared for incident photon energies of 6, 8, 12 and 18 GeV. A collimated bremsstrahlung beam from the Stanford linear accelerator was passed through a 40-in.-long liquid-hydrogen target, and the momentum spectrum of the forward moving protons was measured in the SLAC 20 GeV/c magnetic spectrometer. Single pion production is separated from other processes on the basis of kinematics and the spectrum shape. Author (NSA)

N71-14391# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
PRESS SINTERED HEXABORIDE CATHODES Final Report
W. Wolski 24 May 1969 30 p refs

(NP-18432; Rept-69-12) Avail: AEC Depository Libraries

The fabrication and properties of press sintered lanthanum, yttrium, and gadolinium hexaboride cathodes under operating conditions were studied. The conditions were similar to those which cathodes meet in microtron accelerators. Experimental results for saturated emission and the dependence of pulse current on the cathode temperature are given. NSA

N71-14392# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

PARTIAL WAVE EXPANSION OF THE DENSITY MATRIX (FOR ANY SPIN)

Wojciech Wojcik Jun. 1970 29 p refs

(CEA-N-1301) Avail: AEC Depository Libraries

The helicity amplitude corresponding to the two body reactions is written. The partial wave expansion is derived for the scattering amplitude and the density matrix element; the Fortran program for calculation of the coefficients is given. NSA

N71-14393# University of Southern Calif. Los Angeles. Dept. of Chemistry.

THEORETICAL INTERPRETATION OF THE ELECTRON SCATTERING SPECTRUM OF CO2

Charles R. Clayton, Gerald A. Segal, and Howard S. Taylor [1969] 42 p refs Supported in part by Am. Chem. Soc.

(Grant NSF GP-7861)

Avail: Issuing Activity

A theoretical study of processes observed in electron CO2 scattering experiments is presented. Potential curves for Co2(−) are calculated to determine which scattering processes proceed through formation of short lived negative molecule-ion compound states. The four dissociative attachment processes occurring below 20eV incident energy are shown to result from four different electronic states of CO2(−). Vibrational excitation of CO2 in the 3.0 − 4.5eV incident energy range is shown to proceed through compound state formation. The calculated energies of the compound states are shown to agree with the absorption spectra of CO2(−) trapped in crystalline solids. The inelastic scattering below 3.0eV is shown to be nonresonant and of a direct nature. For this process the leading term in the angular dependence of the cross section is determined by dipole selection rules, which leads to strong forward peaking. Further, the disucssion on direct vibrational excitation cross sections will generally be valid for other nonpolar molecules with infrared-active vibrational modes. Author

N71-14394# Uppsala Univ. (Sweden). Inst. of Physics.

COMPUTER METHOD FOR THE EVALUATION OF THE OPTICAL PROPERTIES OF SCINTILLATION DETECTOR ASSEMBLIES

F. Falk and P. Sparrman (UMEA Univ.) Apr. 1970 20 p refs

(UUIP-679) Avail: AEC Depository Libraries

A computer program for the evaluation of the influence of optical parameters on the properties of scintillation detectors (scintillator and light guide) is described. The detectors considered were cylindrically symmetric, as used in lens spectrometers for electrons. The results of the calculations made for fourteen differently designed scintillator and light guide assemblies indicate that the geometrical design and the reflective coating of the scintillator have predominant influences on the performance of the assembly. Author (NSA)

N71-14398# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.

SOME RADIOLOGICAL OBSERVATIONS AND CHARACTERISTICS OF FALLOUT DEBRIS FROM A NUCLEAR CRATERING EXPERIMENT, SHOT DANNY BOY

Harold M. Mork, K. H. Larson, R. A. Wood, and B. W. Kowalewsky Jul. 1970 32 p refs

(Contract AT(04-1)-Gen-12)

(POR-1818; WT-1818) Avail: NTIS

The fallout pattern from a nuclear device buried in hardrock (basalt) at 33.5 meters below ground surface was delineated by ground survey from the edge of the ejecta out to 7.6 kilometers. An aerial radiometric survey further extended the fallout pattern to about 165 kilometers downwind from the detonation. The distribution of radioactivity per unit area, mass per unit area, and radioactivity per unit mass and particle size were determined. There was little correlation between activity per unit mass and activity per unit area; specific activity varied inversely with particle size. Radioactive decay of samples from selected locations in the pattern showed negative slopes of about 1.3 for the time interval from H + 45 to H + 280 hours. There was a significant increase in the less than 44 micron size fraction with increase in distance from ground zero. More than 70 percent of the radioactivity was associated with this size fraction. Limited data on radionuclides indicated some fractionation with distance. Author (NSA)

N71-14402# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

NEVADA AERIAL TRACKING SYSTEM (NATS): BEATTY WASTE DUMP SURVEY

P. K. Boyns and M. D. Sevart 26 May 1970 13 p Sponsored in part by AEC

(EGG-1183-1481; TR-L-991) Avail: NTIS

An aerial survey of the Beatty Waste Dump and surrounding vicinity at the Nevada Test Site was performed on Feb. 25 and 26 and May 8, 1970 to determine the gamma radiation spectra and gross gamma radiation count rate for the area. The equipment and procedures used are described, and the results are plotted. NSA

N71-14403# Kansas State Univ., Manhattan.

[EXCITED MERCURY ATOMS, LOW ENERGY ELECTRON RADIOLYSIS, AND ENERGETIC TRITIUM ATOMS] Technical Progress Report, 15 Nov. 1969 − 14 Nov. 1970

H. C. Moser 14 Nov. 1970 4 p

(Contract AT(11-1)-584)

(COO-584-46) Avail: NTIS

Experiments were performed on the spectra and photochemical reactions of mercury − ethylene matrices at 24 to 50 K. Studies on the mercury metastable gas chromatography detector were continued. An attempt is being made to develop a cold-cathode, electron emitter for electron radiolysis studies. Studies on reactions of both thermally generated tritium atoms and tritium species from gaseous discharges in the millitorr pressure range are in progress. The effects of surface area on the product yield of thermally generated tritium atoms are being investigated. NSA

N71-14411# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

KINETICS OF OHMIC HEATING IN A TOROIDAL CONFIGURATION [CINETIQUE DU CHAUFFAGE OHMIQUE EN CONFIGURATION TOROIDALE]

J. P. Girard Feb. 1970 48 p refs In FRENCH

(EUR-CEA-FC-538) Avail: AEC Depository Libraries

The properties of a plasma produced by ohmic heating, and confined in a toroidal configuration are described. A simplified model of the plasma is used in which the most important elastic collisions, the gas cycle, and the diffusion of matter and energy are considered. The importance of the physical properties of the walls containing the plasma are demonstrated. The calculations are applied to the existing machines (C Stellerator and Tokamaks) and allow the technological quality of the experiments to be realized and the distribution of particles and energy to be determined. NSA

N71-14413# Columbia Univ., Irvington, N.Y. Nevis Labs.
A TEST OF mu-e UNIVERSALITY FROM HIGH ENERGY MUON-PROTON ELASTIC SCATTERING
Leslie Camilleri (Ph.D. Thesis) 1969 87 p refs
(Contract AT(30-1)-1932)
(NEVIS-176; CU-280; R-674) Avail: NTIS

An experiment on muon-proton elastic scattering was performed at the Brookhaven AGS in the momentum transfer range 0.15 < q squared < 0.9 (GeV/c) squared. Negative muons at incident momenta 6, 11, and 17 GeV/c and positive muons at 6 and 11 GeV/c were studied. The analysis, based on 2000 events per incident momentum and sign, shows that within errors, muon-proton elastic scattering has the same q squared dependence as e-p elastic scattering (in the same q squared range). The muon-proton cross sections obtained are, however, 8% below the e-p ones in absolute magnitude. Using a form factor of the form 1/1 + q squared/Lambda squared to account for the difference, a limit of Lambda > 2.3 GeV/c is set at the 95% confidence level. Author (NSA)

N71-14420# Oak Ridge National Lab., Tenn. Isotopes Div.
ISOTOPE PROGRAM (5000) Quarterly Progress Report, Period Ending 30 Jun. 1970
J. H. Gillette Aug. 1970 10 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3089) Avail: NTIS

About 500 specimens of encapsulated isotopes were fabricated for use in reactor flux and neutron energy measurements. Fabrication of large-area and thick targets by rolling is reported with the aid of the Rocky Flats facilities. Production of tritium targets having more reproducible neutron production by H-3 sorption on Ti or Zr films is reported. In other work, production of high-purity Dy, Sm, and Er metal isotopes is reported. Isotopic separations for production of Hg-199 and Hg-201 and stable isotopes of Fe, Nd, and Sn are in progress. Radioisotopic separations include U-233 collection. Information is included on 180 deg sector isotope separator operation, isotopic material inventory, radioisotope preparation, and stable isotope preparation. NSA

N71-14421# Oak Ridge National Lab., Tenn. Neutron Physics Div.
MEASUREMENTS OF THE NEUTRON FISSION AND ABSORPTION CROSS SECTIONS OF Pu-239 OVER THE ENERGY REGION 0.02 eV to 30 keV
R. Gwin, L. W. Weston, G. de Saussure, R. W. Ingle, J. H. Todd et al 7 Oct. 1969 32 p refs
(ORNL-TM-2598) Avail: NTIS

The neutron absorption and fission cross sections for Pu-239 were measured simultaneously over the neutron energy range from 0.02 eV to 30 keV. An electron linear accelerator was used to produce a source of pulsed neutrons which are collimated to impinge on the Pu-239 sample located at the center of a large liquid scintillator. The prompt gamma rays resulting from fission or from neutron capture were detected using the large liquid scintillator. A fission event was measured in one case by using an ionization chamber containing Pu-239. In another case using metal foils of Pu-239, a technique depending upon the difference in the shape of the pulse height distributions for the prompt gamma rays from fission and capture was used to distinguish fission events. The data were normalized at 0.025 and 0.3 eV using data previously reported. A brief description of the experiments is given and a comparison of the data with previously published data is given. Author (NSA)

N71-14448# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
EXPERIMENTAL INVESTIGATION OF CUSPED CONTAINMENT GEOMETRIES CHALICE Annual Report, 1 Sep. 1969 - 31 Aug. 1970
George J. Yevick and Robin Harvey 31 Aug. 1970 108 p
(Contract AT(30-1)-2582; Proj. Chalice)
(SIT-2582-34; SIT-255) Avail: NTIS

Data taken by Thomson scattering in the cusp region of Chalice shows a non-Maxwellian distribution. A preliminary explanation is that the plasma consists of two components, 90% of the electrons having a temperature of nearly equal to 100 eV and a 10% directional cold component with a kinetic energy nearly equal to 10 eV. This cold component is believed to lie in the sheath and is induced by the external current. At 15 kV in the main bank, the deuterium bremsstrahlung due to the increased density in the cusp overwhelms the Thomson scattering signal for a time > 8 microseconds. Because soft X-rays last for at least 15 microseconds, the conjecture is that hot plasma prevails for times greater than 8 microseconds. A more powerful laser beam is required to verify this. The efficacy of the vanishing mirrors was demonstrated by comparing the containment times of two otherwise similar coil systems. A factor-of-six increase is obtained with the mirrors (3 to 18 microseconds). Improved diagnostics in the form of a new multimode interferometer yielding a sensitivity 40 times greater than the Mach-Zehnder were developed. The theory for measuring the full phase-space distribution function f(x,v) by using two different wavelengths of incident light on the plasma was elucidated. Author (NSA)

N71-14449# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THE ORPHEE D PROGRAM: FAST NEUTRON ATTENUATION IN A LAMELLAR STRUCTURE MADE UP OF WATER AND A DENSE MATERIAL [PROGRAMME ORPHEE D ATTENUATION DES NEUTRONS RAPIDES DANS UN LAMELLAGE EAU-MATERIAU DENSE]
Claude Dupont Jun. 1970 22 p refs In FRENCH
(CEA-N-1311) Avail: AEC Depository Libraries

The fast neutron flux in the side protection of a light water reactor is calculated by the ORPHEE D program. Attenuation in water is treated according to the formalism of a nucleus in water; this is different to the straight-line attenuation used for dense materials. The code also makes it possible to use, without modification, the radial power distribution maps. Author (NSA)

N71-14447# Lyon Univ. (France). Inst. de Physique Nucleaire.
EXCITED Nd 141 LEVELS RESULTING FROM THE DECAY OF Pm 141 ISOTOPE WITH A HALF-LIFE OF 21 MINUTES [NIVEAUX DU NEODYME 141 EXCITES PAR LA DESINTEGRATION DU PROMETHIUM 141 DE PERIODE 21 MINUTES]
A. Charvet, R. Duffait, A. Emsellem, and R. Chery May 1970 18 p refs In FRENCH; ENGLISH summary
(LYCEN-7029) Avail: AEC Depository Libraries

The decay of Pm-141 (T sub 1/2 = 21 min) was studied with Ge(Li) and Si(Li) detectors. The following measurements were made: the energies and intensities of the gamma rays, the gamma-gamma coincidence spectra, and the spectral sum obtained with a Ge(Li) detector of 4 pi geometry. The decay scheme accounts for 19 of the 24 transitions observed in the present work. The half-life of the first excited levels was found to be (1.17 + or - 0.15) 10 to the -9th power seconds. The Q-value of the decay Pm-141 yields Nd-141 was determined to be 3730 + or - 40 keV. The nature of excited states of Nd-141 are discussed in terms of current nuclear models. NSA

N71-14449# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STATIONARY DOSE UNDER A TUBULAR BASE PLATE OF

THE FESSENHEIM TYPE [DOSE A L'ARRET SOUS UNE SOLE TUBULAIRE DU TYPE FESSENHEIM]

Jacques Duco, Jean-Yves Guezenec, and Yves Oceraies May 1970 33 p refs In FRENCH

(CEA-N-1305) Avail: AEC Depository Libraries

The interpretation of neutron and gamma measurements made on the Fessenheim-type base-plate mockup at Naiade-2 provides methods of calculation that are applicable to the reactor for evaluating the dose due to the activation of the metallic structures (Co) and due to the fission products under the base-plate. Author (NSA)

N71-14450# Colorado Univ., Boulder. Dept. of Physics and Astrophysics.

STATISTICAL MODELS OF ELECTRONS IN ATOMS Final Report, 1 Feb. 1969 – 30 Jun. 1970

Nel Ashby and Melvyn A. Holzman 31 Aug. 1970 9 p ref

(Grant AF-AFOSR-1733-69)

(AD-712719; AFOSR-70-2476TR) Avail: NTIS CSCL 7/4

The development of a statistical model for electrons in atoms, based on a local coulomb approximation, is briefly described. In this approximation, the one electron potential is represented by a coulomb potential with variable coefficient. The model predicts some of the features of atomic shell structure. Calculations of total energy are greatly improved over energies calculated on the basis of the Thomas-Fermi model. Comparisons with Thomas-Fermi and Hartree-Fock-Slater calculations are given. Author (TAB)

N71-14451# Uppsala Univ. (Sweden). Inst. of Physics.

X-RAY FLASH TUBE WITH EXCHANGEABLE ELECTRODE SYSTEM

L. Hoegberg, A. Mattsson, N. R. Nilsson, and A. Svedberg Apr. 1970 14 p refs

(UUIP-704) Avail: AEC Depository Libraries

Design and performance data of a field emission X-ray flash tube are presented. The electrode assembly is exchangeable. It is thus possible to adapt the tube impedance to the voltage source or to replace the anode tip when necessary. The tube was tested in the voltage range 100 to 1200 kV; the pulse width at 1200 kV is typically 10 ns and the penetration 5 cm of steel at 1 m. Author (NSA)

N71-14452# City Coll. of the City Univ. of New York, N.Y.

ABSOLUTE TOTAL CROSS SECTIONS FOR THE SCATTERING OF LOW ENERGY ELECTRONS BY RUBIDIUM, CESIUM AND POTASSIUM

Paul J. Visconti, James A. Slevin, and Kenneth Rubin [1970] 30 p refs Submitted for publication

(Grant NSF GP-23996)

Avail: Issuing Activity

Using the atom beam recoil technique, absolute total cross sections were measured for the scattering of electrons in the energy range 0.3 eV to 9eV by potassium, rubidium and cesium. The results of these measurements are in substantial disagreement with the experimental values of Brode, obtained more than forty years ago. On the other hand, the potassium cross sections agree extremely well with the recent calculations of Karule and Peterkop as well as with the experimental values of Collins, et al. For cesium and rubidium, the existing theoretical calculations are not in as good agreement with our results as in the case of potassium. Author

N71-14453# California Univ., Berkeley. Lawrence Radiation Lab.

ELECTRON IMPACT EXCITATION EFFICIENCY CURVES FOR THE FORMATION OF NEUTRAL METASTABLE SPECIES

Amos S. Newton and G. E. Thomas Jun. 1970 3 p refs Presented at the 18th Ann. Conf. on Mass Spectrometry and Allied Topics, San Francisco

(Contract W-7405-eng-48)

(UCRL-19594; CONF-700607-2) Avail: NTIS

A method of making RPD measurements of the excitation efficiency curves for formation of neutral electronically metastable species by crossing an electron beam with an atomic or molecular beam is described briefly. The method is based on the use of a pulsing scheme to distinguish photons from metastables. A diagram of the pulsing scheme and an example of its application of N2 are included. NSA

N71-14454# Atomic Weapons Research Establishment, Aldermaston (England).

ION BEAM SLOW PULSING INJECTOR SYSTEM FOR A 2MV VAN DE GRAAFF

S. G. Emmons, F. A. Howe, and G. James Jun. 1970 12 p refs

(AWRE-0-29-70) Avail: AEC Depository Libraries; UK 2s

An ion beam slow pulsing facility has been developed and installed in the high voltage terminal of the Imperial College 2 MV Van de Graaff. Pulsed ion beams are obtainable with a pulse repetition rate variable between 200 and 1000 c/s. The pulse length is variable between 50 and 10 microseconds to maintain a space/signal ratio of 100/1 + or − 15%. The largest pulsed current obtained to date is 0.80 microamperes while for dc operation a resolved beam of deuterons (or protons) after deflection by an analyzing magnet of 60 microamperes has been obtained. Author (NSA)

N71-14455# Hamburg Univ. (West Germany). Inst. fuer Theoretische Physik.

SUPERPROPAGATOR OF FIELDS WITH EXPONENTIAL COUPLING

H. Lehmann and K. Pohlmeyer Jun. 1970 12 p refs

(DESY-70/26) Avail: NTIS

The vacuum expectation value of the time-ordered product of two exponentials of free fields is defined as a distribution using minimal singularity as a criterion. The implication of this definition for an exponentially self-coupled scalar field is studied in second-order of a perturbation expansion. Author (NSA)

N71-14456# Brookhaven National Lab., Upton, N.Y. Technical Support Organization.

ON THE USE OF GAMMA-RAY SPECTROSCOPY TO DETERMINE Pu ISOTOPIC ABUNDANCES IN PLUTONIUM SOURCES

H. W. Kraner May 1970 12 p refs Sponsored by AEC

(BNL-50237) Avail: NTIS

It is reported that Pu-240, as well as Pu-238, Pu-239, Pu-241, and Pu-242 can be assayed by high-resolution gamma spectroscopy. A small, calibrated, high-resolution Ge(Li) detector was used. Relative intensities of the various Pu isotopes from their gamma spectra are tabulated. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-13560# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EFFECT OF COLLISIONS ON THE NONCOHERENT

SCATTERING SPECTRUM OF A PLASMA HAVING UNEQUAL ELECTRONIC AND IONIC TEMPERATURES [DE L'EFFET DES COLLISIONS SUR LE SPECTRE DE DIFFUSION INCOHERENTE D'UN PLASMA DE TEMPERATURES ELECTRONIQUE ET IONIQUE DIFFERENTES]

Dimitri Lepechinsky (Ph.D. Thesis--Paris Univ., 1968) Jul. 1970 55 p refs In FRENCH

(CEA-N-1295) Avail: AEC Depository Libraries

The method for calculating the spectrum scattered by a plasma in thermodynamic equilibrium in the presence of collisions, based on the generalized Nyquist theorem, is extended to the case of a plasma having unequal electronic and ionic temperatures. Various numerical applications of the expression obtained for the spectrum are presented, together with a comparison of recent experimental results on a laboratory plasma with theoretical predictions. Good agreement exists between these predictions and the experimental spectra. A method is presented for obtaining the electron and ion temperatures of the plasma from the shape of its spectra. Author (NSA)

N71-13570# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

DESIGN AND DEVELOPMENT OF AN UHF CORRELATOR

Bernard Pando May 1970 79 p refs In FRENCH

(CEA-FC-547) Avail: AEC Depository Libraries

The construction is discussed of a high frequency correlator capable of examining the signals in the 1 MHz to 1 GHz band usually encountered in plasma physics. On examining the correlation functions revealed by the correlator, the frequency spectra, and the relation of the dispersion of instability occurring in plasma are obtained. The correlation functions are defined by the type of correlated signals (energy of finite power). The principal applications of correlation functions as well as the conditions for the validity for their mathematical treatment are reviewed. The practical design of the correlator is then described. The correlator uses two sampling oscilloscopes which extract the paired samples from noise and add the product of these sampling pairs according to their delay in a multi-address memory in order to eliminate the noise. Practical results verifying the operation of the correlator are obtained by means of known signals and by comparison with the correlator LETI/15. Author (NSA)

N71-13572# Saha Inst. of Nuclear Physics, Calcutta (India). Theoretical Nuclear Physics Div.

CONDUCTIVITY OF A PLASMA IN A STEADY MAGNETIC FIELD

T. Pradham and B. Dasgupta [1970] 10 p refs

(SINP-TH-67-8) Avail: AEC Depository Libraries

Expressions are derived for the complex conductivity tensor of a homogeneous classical plasma in an external uniform magnetic field, in terms of electric field correlations using the Kubo theory of transport phenomena. The main aim is to bring out explicitly the magnetic field dependence of the conductivity tensor. Exact relations between the conductivity tensor in the presence of the magnetic field and the same tensor in the absence of the magnetic field are obtained. Author (NSA)

N71-13573# Texas Univ., Austin. Dept. of Physics.

ANOMALOUS DIFFUSION AND THERMALIZATION OF TURBULENT PLASMAS Progress Report

Jul. 1970 12 p

(Contract AT(40-1)-3458)

(ORO-3458-9; PR-4) Avail: NTIS

An extensive study was made on the magnetohydrodynamic stability of Tokamak plasmas. The different modes are briefly described. Trapped particle effects and other instabilities are also discussed. NSA

N71-13574# California Univ., Livermore. Lawrence Radiation Lab.

STUDY OF THE TWO-STREAM INSTABILITY IN COLGATE'S SUPERNOVA MODEL OF COSMIC RAY ACCELERATION

Christopher F. McKee 26 May 1970 101 p refs Sponsored by AEC

(UCRL-50880) Avail: NTIS

This study consists of three parts: (1) a nonrelativistic simulation of one-dimensional (1-d) counterstreaming plasmas; (2) theory and numerical experiment for 1-d relativistic counterstreaming plasmas; and (3) the application of the results of the first two parts to Colgate's supernova model of cosmic ray acceleration. The 1-d simulation model used in the first two parts involves integrating the relativistic equations of motion for up to 2 to the 15th power plane charged sheets moving perpendicular to their faces under the influence of electrostatic forces only. In spite of the omission of radiation, the model is physically self-consistent. Both electron and ion sheets are included. The model simulates two infinite, homogeneous, counterstreaming plasmas of equal density moving with velocities + or - v sub o; periodic boundary conditions are imposed. Collisional effects in the model are discussed in both the nonrelativistic and relativistic cases. NSA

N71-13611# Uppsala Univ. (Sweden). Electronics Dept.

CHARGE COLLECTION IN SILICON DETECTORS FOR STRONGLY IONIZING PARTICLES

W. Seibt, K. E. Sundstroem, and P. A. Tove May 1970 19 p refs

(UUIP-711) Avail: AEC Depository Libraries

A simple experimental and theoretical approach was developed for treating the charge collection in semiconductor detectors when dE/dx is so high that plasma effects should be expected to occur. The experiment was evaluated simply by measuring the 10 to 90% charge collection time. The theoretical approach involves assumption of a constant spreading velocity for the charges in the polarized part of the plasma. From this a formula was obtained which expresses the collection time in terms of the particle energy, detector depletion width, field strength at the track, a constant field given by detector parameters, and the mobility. Good agreement between theory and experiments was found over a wide range of energies and for different particles and detectors. Author (NSA)

N71-13724# California State Coll., Fullerton.

MAGNETOHYDRODYNAMIC WAVE PHENOMENA IN SEA WATER

George I. Cohn *In* AGARD Electromagnetics of the Sea Nov. 1970 22 p (See N71-13701 04-23)

Avail: NTIS

In the ocean medium the energy storage modes available are the: (1) electric field; (2) magnetic field; (3) mass density velocity field; (4) pressure field; and (5) gravity field. The simplest types of waves consist of dual energy interchange between only two types of energy storage modes. The dual interchange of energy between the electric field and the magnetic field via electromagnetic and magnetoelectric induction comprises an ordinary electromagnetic wave. The dual interchange of energy between the pressure field and velocity field via Newton's law constitutes an ordinary sonic wave. The simplest MHD waves, Alfven waves, consist of the dual interchange of energy between the mass density velocity field and the magnetic field via action described by Ampere's law, Newton's

law, Ohm's law and Faraday's law. Simultaneous transference of energy between pressure, magnetic and kinetic energy storage modes constitutes magnetic ionic sound waves or magneto-hydrodynamic sound waves and between pressure, electric and kinetic energy storage modes constitutes electroionic sound waves or electrohydrodynamic waves. Simultaneous interactions of all four energy modes gives still more general magnetoelectrohydrodynamic waves. In normal ocean type conditions the gravitational energy storage mode interacts significantly at a surface. Hence an even richer variety of surface waves are possible. Author

N71-13764# Academy of Sciences (USSR), Moscow.
TRANSPORT PROCESSES IN TOROIDAL MAGNETIC TRAPS. 1: INITIAL EQUATIONS
L. M. Kovrizhnykh 1970 44 p refs In RUSSIAN *Its* Preprint No. 38
(NP-18340) Avail: AEC Depository Libraries

The first part of a detailed theoretical analysis of the problem of collisional diffusion in closed magnetic traps is presented. It includes the systematic derivation of basic equations for construction of the theory of transport processes in toroidal systems having complex magnetic field geometry, specifically, the derivation of drift kinetic equations, expressions for particle and energy fluxes, collision integrals, and finally, general relations necessary for future analysis of transport processes. Author (NSA)

N71-13765# Academy of Sciences (USSR), Moscow.
TRANSPORT PROCESSES IN TOROIDAL MAGNETIC TRAPS. 2: TRANSPORT PROCESSES IN WEAKLY IONIZED PLASMA
L. M. Kovrizhnykh 1970 71 p refs In RUSSIAN *Its* Preprint No. 56
(NP-18341) Avail: AEC Depository Libraries

For the case of weakly ionized plasma, expressions were obtained for particle and energy fluxes across the magnetic field in toroidal magnetic traps of various types (Tokamak, levitron, and stellarator) for a wide range of plasma and magnetic-field parameters. Author (NSA)

N71-13772# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT Semiannual Progress Report, 1 Jan.–30 Jun. 1970
30 Jun. 1970 10 p
(NP-18360; PR-19) Avail: AEC Depository Libraries

Research in the department is briefly reviewed, under the following headings: (1) plasma sources, (2) hydromagnetic ionizing fronts, (3) hydromagnetic waves in nonuniform magnetic fields, (4) laser diagnostics, (5) microwave techniques of afterglow in SUPPER I, (6) electron cyclotron harmonic resonance in SUPPER V, (7) far infrared. Recent research reports are also listed. NSA

N71-13773# New South Wales Univ., Kensington (Australia).
WAVES IN NEUTRAL AND IONIZED GASES. CHAPTER 5: LONGITUDINAL PLASMA WAVES AND ZERO SOUND
Warren Preston Wood (Ph.D. Thesis) 28 Feb. 1969 51 p refs
(NP-18364) Avail: AEC Depository Libraries

Aspects of longitudinal electron oscillations in a dilute plasma are considered. Collisional damping corrections to the Landau damping are derived to first order in the collision frequency by means of the Krook model collision term. A comparison is made between the predictions of this model and other approaches to the problem. Author (NSA)

N71-13809# Stanford Univ., Calif. Dept. of Mechanical Engineering.
RADIATION AND NONEQUILIBRIUM EFFECTS ON HEAT TRANSFER FROM A PLASMA IN TUBE FLOW
Bruce D. Hunn Oct. 1969 43 p refs
(Contract AT(04-3)-247)
(SU-247-15) Avail: NTIS

The effects of radiation and nonequilibrium on heat transfer from a partially ionized argon plasma flowing through a water cooled tube were investigated. These effects are especially significant in the entrance region. Preliminary work toward the adaptation of the Spalding–Patankar finite-difference computing scheme to plasma flows is discussed. A model to predict the radiative heat flux to the wall is proposed for inclusion in this finite-difference program. Calculations for typical temperature nonequilibrium conditions are made and it is concluded that elevated electron temperature at the tube wall will not significantly affect the radiative heat transfer. Absorption of radiation by the plasma is considered as it relates to the proposed radiation model. A proposed experiment to measure the radiative flux to the tube wall is outlined and recent modifications to the experimental apparatus are presented. Author (NSA)

N71-13810# Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.
THEORETICAL REACTOR PHYSICS STUDIES Annual Progress Report, 1969
B. P. Rastogi 1970 25 p refs
(BARC-481) Avail: AEC Depository Libraries

The work done in the theoretical physics section during the year 1969 is briefly discussed. Work done in the fields of heavy water reactors, water reactors, fast reactors, molten salt breeders, reactor evaluation, and reactor theory is discussed. Author (NSA)

N71-13960# Stanford Univ., Calif. Inst. for Plasma Research.
PLASMA COMPUTER SIMULATION IN CYLINDRICAL GEOMETRY WITH AZIMUTHAL SYMMETRY
Roland Claude Joseph Le Bail Jun. 1970 127 p refs
(Contract AT(04-03)-799C)
(SU-IPR-373) Avail: NTIS

A computer program that simulates the behavior of a quasi-electrostatic plasma in cylindrical geometry with azimuthal symmetry was developed. The model is represented by an assembly of approximately 2000 charged rings confined by a fixed magnetic-mirror field configuration. The motion of the particles under the influence of their self-consistent electric field and the imposed magnetic field is computed, stepwise in time, according to Newton's law of motion. The bulk of the research was directed toward accuracy and speed both for the solution of Poisson's equation and the equations of motion. The program uses a nine-point formula for the finite counterpart of Poisson's equation which, for a slight increase in computer time, is exact up to the fourth order in both the r and z direction. The solution of this two-dimensional finite-difference approximation is obtained with the help of a fast reversal mapping, which for simple geometric configurations is faster than the best iterative methods. The technique used minimizes the number of multiplications for a mesh having a special number of cells along the z axis; in the computer program a 64 (axial) by N (radial) mesh was used. For the equations of motion, extensive use of area weighting techniques was made both for the evaluation of the magnetic field and for the derivation of the electric field components. Care was taken to reduce the computer noise in the neighborhood of the axis of symmetry. Author (NSA)

N71-13981# Addis Translations International, Woodside, Calif.
INTERACTION OF RELATIVISTIC ELECTRON BEAMS WITH PLASMA. THE PROBLEM OF CRITICAL CURRENTS
L. S. Bogdankevich et al Jun. 1970 62 p refs Transl. into

ENGLISH from the Russian Prepared for Calif. Univ., Livermore. Lawrence Radiation Lab.
(UCRL-Trans-10470) Avail: NTIS

The behavior of an electron beam within an equi-potential drift space alomg the axis of a metallic waveguide was examined. The critical currents investigation involved an examination of the boundary currents in noncompensated electron beams, critical current in compensated, unlimited beams, the effect of the longitudinal dimensions of the system on the critical current in the electron beams, the interaction of relativistic electrons with the plasma, the stability of the beams in the plasma, and critical currents of relativistic electron beams in the plasma. It is concluded that when the electron beam current is lower than both the critical current of the compensated beam and the boundary current of the noncompensated beam, no instability is generated in the system at the neutralized stage. Author (NSA)

N71-14003# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
NONLINEAR PHENOMENA IN COLLISIONLESS PLASMAS
Progress Report No. 1, Revised
Jul. 1970 6 p
(Contract AT(11-1)-2081)
(COO-2081-1-Rev) Avail: NTIS

Research was directed toward the basic understanding of the nonlinear dynamics of unstable loss-cone modes, and low-frequency flute convective cells. Brief summaries of work on each of these matters are given. NSA

N71-14061# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
LARGE AMPLITUDE STEADY STATE HARMONIC CYCLOTRON WAVES. APPENDIX
R. E. Aamodt May 1970 24 p refs
(Contract AT(11-1)-2081)
(COO-2081-2) Avail: NTIS

The spatial dependence of an electron plasma-harmonic ion cyclotron amplifying wave is derived for a steady state loss-cone simulated system keeping the nonlinear ion effects. The saturation amplitude of the wave is found to be extremely small compared to the available free energy, and the amplitude is found to oscillate over distances long compared to the linear amplifying length. Damping of the wave finally occurs because the wave eventually begins to propagate and resonant ions distort the distribution function into a nonamplifying normal monotone decreasing function. Author (NSA)

N71-14062*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LAMINAR FLOW HEAT TRANSFER FROM A GASEOUS PLASMA AT ELEVATED ELECTRON TEMPERATURE IN THE PRESENCE OF ELECTROMAGNETIC FIELDS
T. K. Bose 1 Mar. 1970 23 p refs
(Contract NAS7-100)
(NASA-CR-111725; JPL-TR-32-1447) Avail: NTIS CSCL 20I

A comparatively general theoretical analysis is presented for a laminar steady flow of an ionized gas in the continuum region, with emphasis placed on the heat transfer. The effects of applied electromagnetic fields, nonequilibrium temperature and composition, and variable thermophysical properties are taken into account. A two-temperature plasma is considered in which the electron temperature may exceed the temperature of the heavy particles. Author

N71-14118# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
COLLECTIVE INTERACTIONS IN A FAST THETATRON
T. A. El'Khalafavi et al Sep. 1969 20 p refs Transl. into ENGLISH of Akad. Nauk Ukr. SSR, Kharkov, report KHFTI-69-32 (AEC-tr-7164; KHFTI-69-32) Avail: NTIS

Studies of collective processes in a discharge theta-pinch plasma showed that the kinetic instability in plasma is excited at the expense of anisotropy of electron energy distribution appearing during electron acceleration by the azimuthal electric field of the discharge. A nonadiabetic induction acceleration without producing a steady orbit proved to be the highly probable mechanism of electron acceleration. An epithermal microwave plasma emission consisting of a series of cyclotron harmonics, distributed below the plasma frequency was observed. At high amplitudes of these oscillations the plasma electron energy slowly became isotropic. It was found that the time of balancing of anisotropy was about 0.2 microsec, and magnitude of electron energies acquired and the region of their acceleration are in good agreement with the calculated data. The intensity of microwave emission from plasma increased by the order of two, in the case in which the frequency of higher cyclotron harmonics coincided with plasma frequencies. Author (NSA)

N71-14120# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
STUDIES OF THE THRESHOLD OF HIGH-FREQUENCY INSTABILITIES DURING ELECTRON BEAM INTERACTIONS WITH PLASMA
L. S. Bogdankevich et al Sep. 1970 23 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Moscow, report NP-18102, Preprint 184
(AEC-tr-7159; NP-18102) Avail: NTIS

The critical plasma density corresponding to the threshold of high frequency instability in a plasma/beam system was determined. The critical density was studied as a function of electron beam energy, the external magnetic field strength, and geometric dimensions of the system. The threshold conditions for excitation of electrostatic oscillations derived by the dispersion relation for a limited plasma/beam system were in good agreement with experimental data. Correlation of theoretical and experimental data revealed that, in the experimental conditions examined, the critical magnitude of plasma density corresponded to excitation of the axially symmetric type of oscillations. Author (NSA)

N71-14121# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
COLLECTIVE INTERACTIONS IN LOW-DENSITY PLASMA WITH HIGH-CURRENT GAS DISCHARGE
M. M. M. Masud et al Sep. 1970 8 p refs Transl. into ENGLISH of Akad. Nauk Ukr. SSR, Kharkov, report KHFTI-69-31
(AEC-tr-7165; KHFTI-69-31) Avail: NTIS

Experimental studies were made of instabilities appearing in electrode discharge during its initial stages, when the degree of ionization of the working gas was small and the plasma density was low. It is shown that the collective process is similar to the interactions during external electron beam injection into plasma and differs considerably from the processes developing in dense highly ionized plasma in high electric fields. Data obtained indicate that the collective processes can substantially influence the mechanism of breakdown of neutral gas. Author (NSA)

N71-14128*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
COMPUTER STUDY OF CONVECTION OF WEAKLY IONIZED PLASMA IN A NONUNIFORM MAGNETIC FIELD
Jeng-Nan Shiau Dec. 1970 40 p refs Submitted for publication
(NASA-TM-X-65396; X-641-70-426) Avail: NTIS CSCL 20I

A weakly ionized plasma in a strong and nonuniform magnetic field exhibits an instability analogous to the flute instability in a

fully ionized plasma. The instability sets in at a critical magnetic field. To study the final state of the plasma after the onset of the instability, the plasma equations were numerically integrated assuming a certain initial spectrum of small disturbances. In the regime studied, numerical results indicate a final steadily oscillating state consisting of a single finite amplitude mode together with a time independent modification of the original equilibrium. Numerical results agree with the analytic results obtained by Simon in the slightly super-critical regime. As the magnetic field is increased further, the wavelength of the final oscillation becomes nonunique. There exists a subinterval in the unstable wave band. Final stable oscillation with a wavelength in NAL subinterval can be established if the initial disturbance has a sufficiently strong component at the particular wavelength. Author

N71-14129*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PLASMA PHYSICS ABSTRACTS, 1 JANUARY–31 DECEMBER 1970
David C. Montgomery and Donald A. Gurnett 31 Dec. 1970 8 p refs
(Grant NGL-16-001-043)
(NASA-CR-111734) Avail: NTIS CSCL 20I

A collection of ionospheric and theoretical abstracts of plasma physics is presented. E.H.W.

N71-14162# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
ANOTHER APPROACH TO THE INJECTION OF RELATIVISTIC ELECTRONS INTO AN ASTRON-LIKE DEVICE
Moshe Friedman Jun. 1970 16 p refs
(Contract N00014-67-A-0077-0002)
(AD-711822; LPS-47) Avail: NTIS CSCL 18/1

An approach to the injection phase of ASTRON-like devices was investigated. A rotating cloud of relativistic electrons was injected into three different magnetic field configurations. Preliminary results are presented. Author (TAB)

N71-14218 Cornell Univ., Ithaca, N.Y
TRANSPORT PROPERTIES OF PARTIALLY IONIZED NONEQUILIBRIUM GASES
Gerhard Ludwig Grohs (Ph.D. Thesis) 1969 309 p
Avail: Univ. Microfilms: HC $13.95/Microfilm $4.00 Order No. 69-20974

A derivation of conservative equations and transport coefficeicnet for partially ionized gases is presented. The range covered is that of weakly to fully ionized plasmas with finite departures from thermal and chemical equilibrium. Although the final formulation is in terms of monatomic gases, the approach can be extended to polyatomic gas mixtures. Transfer equations are derived from Boltzmann-s equation with a 13-moment approximation to the species distribution functions. A strong collision model is developed which utilizes the concept of a collision complex. Expressions for both species and mixture transport variables are derived from the equations of transfer of species momentum, viscous stress, and heat flux. The results exhibit the coupling between heat flux and diffusion, in presence of electric and magnetic fields. In the limits of weak and complete ionization they are found to agree with the existing literature. Dissert. Abstr.

N71-14238# Academy of Sciences (USSR), Moscow. Inst. of Physics.
NEW SCHEME FOR A TWO-INLET STELLARATOR
I. S. Danilkin and I. S. Shpigel 1970 31 p refs In RUSSIAN
(NP-18378) Avail: AEC Depository Libraries

A new design is discussed for a two-inlet stellerator capable, in principle, of satisfying new requirements for plasma containment. The new system exhibits a higher stability of magnetic field configuration, and is less influenced by the toroidality and other faults of the construction; also, it is capable of more efficient particle containment and has a latitude of theta > or = to 0.1. The construction of the system provides easy access to the operating area filled with plasma and offers good vacuum necessary for the experiments. The stellarator is very economical in using the magnetic field at low mechanical loads. Containment of plasma in the stellarator field under exceptionally clean conditions was achieved. NSA

N71-14239# Institute of Nuclear Research, Warsaw (Poland).
INFLUENCE OF A COLLISIONAL PLASMA BACKGROUND ON THE TWO-STREAM INSTABILITY
E. Infeld and A. Skorupski 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome
(INR-P-1188; Conf-700817-1) Avail: AEC Depository Libraries

Classification of the two-stream instability into convective and absolute for two hot streams and a collisional plasma background is outlined. The case of cold streams is solved completely. The collisional background has the effect of quenching the absolute instability for some stream parameters. Author (NSA)

N71-14240# Academy of Sciences (USSR), Moscow. Inst. of Physics.
POSSIBILITY OF MEASURING THE DIRECTED FLOW IN PLASMA CONFINED IN TOROIDAL MAGNETIC TRAPS
M. S. Berezhetskii, S. E. Grebenshchikov, I. A. Kossyi, and I. S. Shpigel 1970 23 p refs In RUSSIAN
(NP-18372) Avail: AEC Depository Libraries

A plane grid probe was used for measuring a complete flow in confined magnetic traps. Calculations utilizing the Bohm concept for resolving the current in the plane probe collector placed in a magnetized plasma are presented, and Galaktionov's corrective formulas that take the magnetic field into account are used. NSA

N71-14241# Academy of Sciences (USSR), Moscow. Inst. of Physics.
POSSIBLE MECHANISM OF PLASMA DIFFUSION IN STELLARATOR L-1
M. S. Berezhetskii, S. E. Grebenshchikov, L. M. Kovrizhnykh, I. A. Kossyi, I. S. Shitnikova et al 1969 8 p refs Presented at the 3d Conf. on Controlled Fusion and Plasma Phys., Utrecht
(Conf-690619-15) Avail: AEC Depository Libraries

The abnormally high rate of plasma diffusion in closed systems in the L-1 stellarator was analyzed, and published data on the mechanism of plasma escape from traps are discussed. An attempt was made to correlate the experiments with diffusion theory, using calculations of equilibrium electric fields and plasma life-time parameters close to experimental. Results showed that the theory, obviously predicted correctly the magnitude of equilibrium electric fields, however, there was a difference between the experimentally observed and calculated time of plasma confinement. Observations of L-1 plasma potential functions and the confinement time indicate that losses are primarily due to collisional diffusion. NSA

N71-14248# General Electric Co., Philadelphia, Pa. Missile and Space Div.
RATE PROCESSES IN NON-EQUILIBRIUM PLASMAS Final

Technical Report
Norman A. Evans Jul. 1970 28 p refs
(Contract F44620-68-C-0048)
(AD-712710; AFOSR-70-2480TR) Avail: NTIS CSCL 20/9

An experimental study of the establishment of non-equilibrium ionization in flowing cesium-seeded argon has been continued with emphasis on rate controlled aspects. In addition to the usual ionization and recombination rates, a seed diffusion rate to the electrodes and an electrode thermal inertia have been identified as possibly important in certain applications involving short running times. From the limited amount of data obtained, it was found that an applied transverse magnetic field increased the plasma power dissipation rate with respect to conductivity, the overall electron density recombination rate, and the required plasma breakdown voltage. Author (TAB)

N71-14249# Academy of Sciences (USSR), Leningrad.
TRANSFORMATION AND ABSORPTION OF HIGH FREQUENCY WAVES IN PLASMA
V. E. Golant and A. D. Piliya 1969 10 p refs Presented at the 3d Conf. on Controlled Fusion and Plasma Phys., Utrecht
(Conf-690619-16) Avail: AEC Depository Libraries

Studies are discussed for electromagnetic wave absorption in the frequency range between electron cyclotron and the upper and lower hybrid frequencies. NSA

N71-14250# Academy of Sciences (USSR), Moscow. Inst. of Physics.
STOCHASTIC PROCESSES IN PLASMA
V. N. Tsytovich 1969 111 p refs In RUSSIAN and ENGLISH Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest.
(Conf-690803-31) Avail: AEC Depository Libraries

The following topics are discussed: (1) the spectrum of plasma turbulence, (2) correlation of stochastic fields (turbulent and stochastic heating), (3) stochastic acceleration of particles, (4) radiational turbulence and the cosmic ray problem, and (5) penetration of electromagnetic perturbations in turbulent plasma and the second sound in plasma. NSA

N71-14251# Los Alamos Scientific Lab., N.Mex.
PROPOSAL FOR A SHOCK-HEATED TOROIDAL z-PINCH EXPERIMENT
James A. Phillips Nov. 1969 8 p refs
(Contract W-7405-eng-36)
(LA-4352) Avail: NTIS

A shock-heated toroidal z-pinch experiment is proposed in which a plasma temperature of 1 keV is anticipated. The fast rising z current is driven by a magnetic energy storage system similar to that successfully used in a linear experiment. Author (NSA)

N71-14252# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
THEORY OF THE DYNAMIC STABILIZATION OF THE RAYLEIGH-TAYLOR INSTABILITY
F. Troyon and R. Gruber Oct. 1970 16 p refs Sponsored by the Swiss Natl. Sci. Found.
(LRP-45/70) Avail: NTIS

The possibility of dynamically stabilizing the Rayleigh-Taylor instability of the interface between two heavy fluids is discussed. It is shown that both viscosity and interfacial tension are necessary to stabilize the short wavelength perturbations. Experimental results on the liquid-air interface are reproduced. Dynamic stabilization of plasma confinement can be conceived by analogy with the fluid case. The differences between a plasma and a fluid are examined to show the limitations of the analogy. Author

N71-14280# Nagoya Univ. (Japan). Inst. of Plasma Physics.
UNSTABLE BGK SOLUTION DUE TO EXCITATION OF AN ION ACOUSTIC WAVE
T. Hatori, R. Sugihara, and T. Watanabe Sep. 1970 12 p refs
(IPPJ-99) Avail: NTIS

The response of trapped electrons in a periodic potential trough produced in a plasma to a low frequency perturbation and the stability of BGK solutions are discussed. When any unevenness of the distribution function is present in the region of trapped particles, whether it is smooth or not, it causes a polarization which is resonant with low frequency oscillations, such as ion acoustic waves, and the system becomes unstable. For a BGK solution to be stable, the distribution of the trapped region must be at least flat and be smoothly connected with that of the untrapped region. Author

N71-14280# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR BEHAVIORS OF ION-WAVE
Masashi Kako and Tsuguhiro Watanabe Aug. 1970 22 p refs
(IPPJ-86) Avail: NTIS

A partial differential equation is shown to govern the finite amplitude ion wave propagating through a macroscopic plasma with an ion beam in the neighborhood of a marginally stable state. It is found that wave trains or solitary waves exist. The temporal evolution of initial disturbances is investigated numerically. Author

N71-14281# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRODUCTION OF ION STREAM COMPOSED OF TWO COMPONENTS IN VELOCITY DISTRIBUTION
Tadao Honzawa Sep. 1970 15 p refs
(IPPJ-97) Avail: NTIS

Results of an experiment investigating a new type source of ion stream composed of two components in energy distribution are reported. A diffusion-type plasma source is used, which is formed with two arrays of oxide-coated cathode rods and five sheets of metallic mesh grids. The energy distribution of the ion stream is observed with an electrostatic energy analyzer, whose resolution is 4%. Ion streams of argon, helium, nitrogen, and their mixtures are obtained, the energy of which ranges from 50 to 500 eV. The energies of two components of ion stream are determined by the biases externally applied to two pairs of grids, and their relative intensities can be controlled by adjusting the temperature of the fore array of cathode rods and/or the potential of the intermediate grid. Author

N71-14282# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPERIMENTAL INVESTIGATION OF A SLOW THETA PINCH PLASMA (BSG II)
Kiyoshi Hayase and Tokeyoshi Obuda Sep. 1970 39 p refs
(IPPJ-96) Avail: NTIS

Various properties and behaviors of a plasma in a slow theta pinch are measured and investigated in detail. Basic parameters such as the temperature and density are measured in a wide pressure range by laser scattering and interferometry. The characteristics of the temperature and the compression time are compared with a snow plow model, and they are in good consistency. The instability appears at the pressure higher than 50 mtorr but is suppressed at the pressure higher than 350 mtorr. Some discussions about the stabilization effects are described. The end loss is also measured and the e-folding time is more than 20 microseconds. To produce a plasma of low density, z-discharge preionization is applied, and the slow theta pinch is operated in the first half cycle. A new method is applied to initiate the z-discharge even at very low pressure. This allows an investigation of a collisionless plasma in a theta pinch, in which some anomalies on the contraction and heating are observed. Author

N71-14300# London Univ. (England). Dept. of Aeronautics.
LANGMUIR PROBE DETERMINATIONS OF ELECTRON ENERGY DISTRIBUTIONS IN A PLASMA WITH A NON-MAXWELLIAN COMPONENT
A. R. Martin Oct. 1970 18 p refs Presented at EUROMECH 18 Colloq. on Advanced Instrumentation and Measuring Tech. in Hypersonic Flow, Southampton, Engl., 16–18 Sep. 1970
(RM-70/3) Avail: NTIS

Studies of the electron bombardment ion engines reveal the presence of non-Maxwellian distribution of the particle energy in the discharge. This is due to high energy primary electrons accelerated through the cathode sheath to energies near the discharge voltage. Discussions are given of a method of predicting the existence of this non-Maxwellian distribution, and a method of analyzing the current-voltage probe curves produced. The latter enables the primary and secondary (Maxwellian) components to be separated. This is illustrated by reference to published data on mercury and cesium, and by new data on argon. In addition, a simple graphical method of determining the actual energy distribution of the electrons, which eliminates the need to calculate second derivatives of the probe curves, is used on the curves, and data on the distributions found in argon under various discharge conditions are presented. Author

N71-14301# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
THE MOTION OF IONS IN PERPENDICULAR AND UNIFORM STRONG ELECTRIC AND VARIABLE MAGNETIC FIELDS WITH SYMMETRIC RESONANT CHARGE EXCHANGE COLLISIONS
J. C. Sherman Aug. 1970 50 p refs
(Rept-70-15) Avail: NTIS

Ion motions in uniform and almost perpendicular electric and magnetic fields were considered. Symmetric resonant charge exchange collisions were assumed important and ion-ion Coulomb collisions and elastic ion-neutral collisions were treated as perturbations. Constant mean free path and constant mean free time models of the exchange collisions are discussed and it is shown that the perturbing collisions effect the anisotropy of the ion velocity distribution. Author (ESRO)

N71-14302# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
FUSION DEVICES FOR PLASMAS ROTATING AT SUPER-CRITICAL VELOCITIES
B. Lehnert Sep. 1970 18 p refs
(Rept-70-33) Avail: NTIS

The velocity limitation in some rotating plasma devices may be caused by an enhanced plasma-neutral gas interaction at the end walls which bound the plasma in the magnetic field direction. A large number of non-thermal ions should be produced by the back-scatter of neutrals from these walls and if the interaction is due to such ions, or to a process which forms azimuthal electric field inhomogeneities, it should be possible to eliminate the velocity limitation by short-circuiting the azimuthal electric field. If these predictions are correct the power losses due to ions and electrons escaping from a rotating plasma device could be reduced to balance the thermonuclear power at high temperatures. Author (ESRO)

N71-14320# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
NEUTRAL GAS EFFECTS ON COSMICAL PLASMAS
B. Lehnert Aug. 1969 14 p refs
(NP-18421; Rept-69-25) Avail: AEC Depository Libraries

Some effects of neutral gas interaction taking place in cosmical plasmas in the presence of a magnetic field are considered. Inhomogeneous states are studied where there are limited regions of fully ionized plasma being bounded by regions of neutral or lowly ionized matter. The fully ionized plasmas will interact with the surrounding neutral gas through partially ionized boundary regions, in a way which strongly depends on an immersed magnetic field. On account of the neutral gas interaction, a minimum power input and temperature exist below which the fully ionized plasma cannot be sustained. This limit is sharply defined and should produce abrupt appearances or disappearances of cosmical phenomena under certain conditions. It is shown that the fully ionized plasma cannot be sustained in a stationary or quasi-stationary state, unless the power input and the temperature are kept above a certain minimum level. Author (NSA)

N71-14321# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
INTERACTION BETWEEN A PLASMA AND A NEUTRAL GAS
Lars Danielsson Dec. 1969 28 p refs Revised
(NP-18414; Rept-69-17-Rev) Avail: AEC Depository Libraries

An experiment where a high-velocity plasma stream penetrates a stationary neutral-gas cloud in a magnetic field is described. It was found that the interaction between the plasma and the gas was far more violent than what can be expected from simple atomic interaction theories. The parameters are such that the character of the interaction is collisionless. The observations demonstrate that the plasma was very efficiently retarded as it penetrates into the gas cloud and that the electron energy distribution changes drastically towards higher energies, at least for a part of the population, resulting in partial ionization of the gas. In order to account for the observations it is necessary to assume some kind of collective interaction between the plasma and the neutral gas. The results are analyzed from the point of view of Alfven's critical velocity hypothesis. Author (NSA)

N71-14323# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
STUDY OF SHORT WAVELENGTH INSTABILITIES IN THE CONFINEMENT OF A COLLISION DOMINATED PLASMA BY A ROTATING MAGNETIC FIELD
F. Troyon Oct. 1970 16 p refs Supported by the Swiss Natl. Sci. Found.
(LRP-42/70) Avail: NTIS

The stability of a collision dominated plasma confined by a rotating magnetic field is considered, given the frequency of rotation and the ion collision frequency. Short wavelength perturbations are the most difficult to stabilize. Growth rates of parametric instabilities are shown to be so large as to make impossible any attempt to use a frequency much lower than the above mentioned limit. A simple interpretation of a wide region of instability, which cannot be ascribed to any parametric instability, is given in terms of an equivalent negative resistance. Author

N71-14385# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
ON THE THEORY OF THE LOW PRESSURE POSITIVE COLUMN AT HIGH CURRENT DENSITIES
Staffan Torven May 1970 33 p refs Revised
(NP-18427; Rept-69-16-Rev) Avail: AEC Depository Libraries

A stationary gas-discharge plasma was investigated at such low pressure that collisions between positive ions and other particles can be neglected. The concepts of plasma approximation and sheath approximation were analyzed and the result was applied to the plane symmetric discharge. When single-stage ionization is considered and the balance between the net fluxes of positive ions and neutrals is taken into account, it was proved that the stationary

plasma density is uniquely determined by the velocity and density of the inward gas flux at the plasma boundary, the electron temperature, and the ionization rate. Limits for the maximum obtainable plasma density were calculated for the plane discharge bounded by wall sheaths and, in a simplified model, for a plasma bounded by a space charge double layer. It is suggested that the gas is in a maximally ionized stationary state when limitation of the steady discharge current occurs and nonlinear instabilities (arc chopping, stenotron oscillations) appear in a low-pressure discharge. Author (NSA)

N71-14396# Los Alamos Scientific Lab., N.Mex.
NUMERICAL SIMULATION OF THE WEIBEL INSTABILITY IN ONE AND TWO DIMENSIONS
R. L. Morse and C. W. Nielson Apr. 1970 21 p refs
(Contract W-7405-eng-36)
(LA-4482) Avail: NTIS

A Particle-In-Cell simulation method for doing full electromagnetic simulations of collisionless plasma phenomena is described and applied to the Weibel instability in one and two dimensions. Magnetic particle trapping and subsequent mode coalescing are seen. Total magnetic field energy is seen to increase after initial instability saturation in one-dimensional cases but to decrease in two dimensions. Author (NSA)

N71-14405# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
ION SEPARATION EFFECTS IN THE BOUNDARY REGION OF A PLASMA SURROUNDED BY NEUTRAL GAS
B. Lehnert Jul. 1969 15 p refs
(NP-18420; Rept-69-24) Avail: AEC Depository Libraries

A one-dimensional model is considered where a fully ionized plasma is separated from a neutral gas by a homogenous magnetic field directed along the plasma boundary. The plasma and the neutral gas consist of two different types of ions and neutral particles. In a stationary state the outflux of plasma by diffusion across the magnetic field is compensated by an influx of neutrals which are ionized in a partially ionized boundary region. It was found that the ratio between the ion densities in the fully ionized region will in general differ from the density ratio of the two types of neutrals being present in the neutral-gas region. This provides a separation mechanism with applications both to cosmical and laboratory plasmas. Author (NSA)

N71-14415# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
EXPERIMENTS WITH AN ELECTRODELESS PLASMA ACCELERATOR
L. Lindberg Jan. 1970 30 p refs Revised
(NP-18422; Rept-69-15-b) Avail: AEC Depository Libraries

Experiments with an electrodeless plasma gun (conical theta pinch) are described. The gun was intended as a plasma source for studies of collision between plasma and magnetic, solid, or gaseous obstacles. The plasma was shot out into an axial guiding magnetic field of the order 0.02 Vs/per square meter. It was studied by means of electric potential probes, floating electric double probes, magnetic loops and probes, and an ion energy analyzer. The plasma was emitted from the gun in a narrow time range. Three special features were studied: (1) a precursor plasma with very violent potential fluctuations; (2) the occurrence of a twisted structure of the guiding magnetic field; and (3) the formation of plasmoids or plasma rings. Author (NSA)

N71-14416# Commissariat a l'Energie Atomique. Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
GROWTH RATE OF ELECTROSTATIC WAVES IN AN ANISOTROPIC MEDIUM WITH OR WITHOUT COLD PLASMA [TAUX DE CROISSANCE DES ONDES ELECTROSTATIQUE DANS UN MILIEU ANISOTROPE AVEC OU SANS PLASMA FROID]
J. Jacqinot and C. Leloup Apr. 1970 29 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-541) Avail: AEC Depository Libraries

The growth rates of electrostatic waves are calculated in an infinite homogeneous plasma composed of a hot anisotropic electron population represented by a Maxwellian distribution function with two temperatures and a cold plasma. The analysis is restricted to frequencies below the electron cyclotron frequency. A simplified analytical treatment and an exact numerical calculation are used to study the effect of various parameters: propagation angle, pressure anisotropy, hot and cold plasma densities. Author (NSA)

N71-14460# Institute of Nuclear Research, Warsaw (Poland).
SPECTROSCOPIC MEASUREMENTS OF THE RADIAL TEMPERATURE DISTRIBUTION IN POWDER SEEDED ARGON PLASMA [SPEKTRALNE POMIARY RADIALNYCH ROZKLADOW TEMPERATURY PLAZMY W PLAZMOTRONIE INDUKCYJNYM W OBECNOSCI TRUDNOTOPLIWYCH PROSZKOW]
Jacek Lesinski 1970 37 p refs In POLISH; ENGLISH summary
(INR-1173) Avail: AEC Depository Libraries

Studies on temperature distribution in powder seeded-induction plasma torches are described. The gas was argon and the powder material was Al2O3 · TiO2. Nominal output power of the supplying RF generator amounted to 10 kW and its frequency was 2.9 MHz. Radial and axial temperature distribution was measured in clean argon plasma for four values of supply power. Radial temperature distribution in powder-seeded argon plasma was measured with the intensity line ratio method and absolute Ar line and continuum intensity methods. Temperatures obtained from intensities of powder material atoms are much less and their radial distribution is different from that obtained from argon spectra. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-13609# Paris Univ. (France). Laboratoire d'Optique.
INVESTIGATION OF THE INFLUENCE OF DEFECTS IN THIN METALLIC FILMS ON THEIR OPTICAL AND ELECTRICAL PROPERTIES Final Technical Report
F. Abeles, M. M. Couzinesu, and M. L. Theye Oct. 1970 34 p refs
(Contract DAJA37-70-C-0150)
(AD-713022; E-1280) Avail: NTIS CSCL 20/6

The purpose of the present work was to determine the optical properties of thin Ag films and to investigate the influence of their crystallographic structure on these properties. The film surfaces were certainly flatter and smoother than the surface of usual optical samples, which is important in order to prevent surface effects. The optical results can be summarized as follows: A low value of the optical mass, independent of the film structure, was found (0.87); The optical relaxation time strongly depends on the film structure, and is always smaller than the electrical relaxation time (approximately 2); The onset of interband transitions was accurately determined (3.88 eV); In some cases a supplementary absorption band was observed, peaking at 1.5 eV, certainly related to the presence of impurity or defects centers, and No displacement of the plasmon frequency (at Eta-Omega sub p equal to 3.77 eV)

with film structure was observed, only a damping of the resonance peak in the energy loss function IM (1/e) for poor films. Author (TAB)

N71-13894# Technische Hochschule Hannover (West-Germany). Fakultaet fuer Maschinenwesen.

LIMITATIONS IN DETERMINING MICROGEOMETRIC ROUGHNESS ON SOLID BODY SURFACES BY THE TRACE CUTTING MEASUREMENT METHOD AND THE FUNCTIONAL DIGITAL EVALUATION OF VERTICAL CUTTING PROFILES [GRENZEN BEIM BESTIMMEN MIKROGEOMETRISCHER ABWEICHUNGEN DER OBERFLAECHEN FESTER KOERPER MIT FUEHLSCHNITTMESSVERFAHREN UND DAS DIGITALE, FUNKTIONSGERECHTE AUSWERTEN SENKRECHTER PROFILSCHNITTE]

Harald Halbig (Ph.D. Thesis) 1969 176 p refs In GERMAN Avail: NTIS

The use of surface roughness measurements on solid bodies in determining their characteristic property functions established a pronounced correlation between microgeometric surface layer properties and microgeometric functional behavior. Electron microscopic evaluation of vertical cutting profiles, obtained with a precision stylus, and statistical evaluation of profile density distributions reflected the topological surface properties of the various geometrical functions. Periodic and irregular microgeometric abnormalities in sample surface profile fields depicted the roughness values. Transl. by G.G.

N71-13961# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.

SUPERCONDUCTING TRANSITION TEMPERATURES AND LATTICE PARAMETERS OF SIMPLE-CUBIC METASTABLE Te-Au SOLID SOLUTIONS CONTAINING Fe AND Mn

L. R. Newkirk and C. C. Tsuei Aug. 1970 25 p refs
(Contract AT(04-3)-822)
(CLAT-822-9; Rept-7) Avail: NTIS

The effects of Fe and Mn impurity atoms on the lattice parameter and on the superconducting transition temperature in Te–Au alloys were investigated. It appears that an anomaly in lattice parameters in these alloys is due to the effect of conduction electrons and is not influenced by the existence of the Te2Au compound in equilibrium alloys. This conclusion demonstrates that a lattice parameter anomaly of the type occurring in many hexagonal alloys can also occur in cubic systems. In addition, it seems that his effect depends only on the concentration of conduction electrons and not on alloy composition. Considering the independent evidence showing that the Fermi surface contacts a Brillouin-zone boundary where the lattice parameter anomaly occurs, the conclusion that the lattice spacings in a cubic system may be influenced by this contact is clearly suggested. NSA

N71-13982*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTRON RADIATION EFFECTS IN RUBY

Hubert H. Grimes Washington Dec. 1970 15 p refs
(NASA-TN-D-7025; E-5936) Avail: NTIS CSCL 20L

The effect of 2-MeV electron bombardment on ruby laser crystals was studied by optical absorption spectroscopy. Except for a new ultraviolet absorption band attributed to aluminum interstitial ions, the electron radiation induced spectrum found was very similar to that reported for X- or gamma-ray irradiated crystals. These bands, which saturated with dose, are accounted for by the presence of chromium (+4) ions and F-centers produced by the radiation. Probable ionization processes consistent with these findings and with those of other investigators are given. Author

N71-13983# Radio Corp. of America, Harrison, N.J.

SILICON GERMANIUM THERMOELECTRIC MATERIALS AND MODULE DEVELOPMENT PROGRAM Quarterly Progress Report, 1 Jan. –31 Mar. 1970

31 Mar. 1970 55 p refs
(Contract AT(29-2)-2510)
(ALO-(2510)-9; QPR-9) Avail: NTIS

Efforts devoted to alternate hot shoe materials are reported on Si-coated graphite specimens which were operated in air at 1000 to 1200 C for 5000 hr. Performance of the C-4 converter was evaluated for short circuits to ground. Results indicate that ZrO2 yarn is conductive at C-4 operating temperatures. The fabrication of the C-7 converter was completed during the period. The C-1 converter completed 13,900 hr testing during the period. Test results on these converters are included along with results of performance testing of a 4-thermocouple module at constant 1000 C while varying the cold shoe temperature at 200 to 500 C. NSA

N71-14008# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Div.

VAPORIZATION KINETICS OF ZINC OXIDE AND CADMIUM SULFIDE SINGLE CRYSTALS

Ralph Beaumont Leonard (Ph.D. Thesis) May 1970 130 p refs
(Contract W-7405-eng-48)
(UCRL-19187) Avail: NTIS

Zinc oxide was studied at 1107 C. The Zn(0001) face vaporizes at a rate that is higher than the O(0001) face by a factor of approximately 2.8. The opposite basal faces also develop different steady state morphologies. The steady state Zn(0001) face resemble sharp mountain peaks separated by narrow valleys with no obvious crystallographic features while the steady state O(0001) face is an array of hexagonal pits with stepped sides. Exposure of the crystal to water vapor at room temperature reduces the initial vaporization rate of the Zn(0001) face by more than a factor of ten. Cadmium sulfide was studied over the temperature range of 609 C to 676 C. The Cd(0001) face vaporizes at a rate that is higher than the S(0001) face by a factor of approximately 1.3. The observed pressure from the Cd(0001) face was an order of magnitude less than the equilibrium pressure. The steady Cd(0001) face is an array of hexagonal pits while the steady state S(0001) face resembles rounded mountain peaks separated by narrow valleys. The average apparent activation enthalpies and the equilibrium enthalpy of vaporization for CdS were determined. Author

N71-14083*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Apr. –30 Jun. 1970

W. Murray Bullis and A. J. Baroody, Jr., eds. Nov. 1970 59 p refs Supported jointly by NASA, DASA, Navy Strategic Systems Proj. Office, and Navy Electron. Systems Command
(NASA-CR-111784; NBS-TN-560) Avail: SOD $0.60 Catalog No. C-13.46:560; NTIS CSCL 20L

The development of methods of measurement for semiconductor materials, process control, and devices is described. Principal emphasis is placed on: (1) measurement of resistivity, carrier lifetime, and electrical inhomogeneities in semiconductor crystals; (2) evaluation of wire bonds, metallization adhesion, and die attachment; and (3) measurement of thermal properties of semiconductor devices and electrical properties of microwave devices. Work on related projects on silicon nuclear radiation detectors and specification of germanium for gamma-ray detectors is also described. Supplementary data concerning staff, standards committee activities, technical services, and publications are included as appendixes. Author

N71-14151*# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
A STUDY OF DEFECT STRUCTURES WITH THE FIELD ION MICROSCOPE Semiannual Report, 1 Mar.–31 Aug. 1970
J. J. Hren 31 Aug. 1970 35 p refs
(Grant NGR-10-005-039)
(NASA-Cr-115771; SAR-9) Avail: NTIS CSCL 20L

The Fourier synthesis method was used to interpret field ion micrographs of fully ordered and partically ordered alloys. Some factors contributing to the discrepancy between ideal and experimental cases are investigated. A comparison of the synthesis and plate image intensifier methods show the intensifier has the advantage of reducing the gas impact effect on the field evaporation and it has a greater gain factor. E.H.W.

N71-14219 Northwestern Univ., Evanston, Ill.
THE EFFECT OF THE SPIN-ORBIT INTERACTION AND STRAIN ON THE ENERGY BANDS AND OPTICAL PROPERTIES OF SOME DIAMOND TYPE SEMICONDUCTORS
Luis Roberto Saravia (Ph.D. Thesis) 1969 379 p
Avail: Univ. Microfilms: HC $17.10/Microfilm $4.85 Order No. 70-152

The pseudopotential form of the spin-orbit contribution to the Hamiltonian of the crystal is parametrized in terms of only one parameter. The spin-orbit splittings are calculated in Ge and Si, and they are compared with experimental and other theoretical results. The strain problem is studied using the Pikus-Bir transformation and parametrizing the pseudopotential in the deformed crystal using an expression obtained in the rigid ion approximation. In addition to the three atomic form factors, five other parameters are needed. One of them determines the internal strain of the diamond type crystal structure. The other four are directly related to the atomic form factors as a function of the absolute value of the reciprocal vector. In order to determine the effect of the spin-orbit interaction and strain on the optical properties, the imaginary part of the dielectric constant is calculated as a function of frequency. It is necessary to increase considerably the resolution of the calculations performed in previous works to observe the small changes produced by the perturbations. Dissert. Abstr.

N71-14220 Illinois Univ., Urbana.
ELECTRIC FIELD EFFECTS ON OPTICAL ABSORPTION BY EXCITONS IN SEMICONDUCTORS
Daniel Fahnestock Blossey (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-793

The effect of an electric field on exciton oscillator strengths is calculated for both bound and continuum states. The calculation is performed for Wannier excitons using the effective mass approximation at both the M sub 0 and M sub 3 type edges. In comparison with single-particle theory, the inclusion of the electron-hole interaction increases the oscillator strengths at the M sub 0 edge and at the same time enhances and shifts the Franz-Keldysh type oscillations near the edge. The effect of the electron-hole interaction on the M sub 3 edge is to decrease the oscillator strengths and the amplitude of the Franz-Keldysh type oscillations near the edge. It is also shown that, for small electric fields, the splittings and shifts of the bound states with electric field are in accordance with the well known perturbation treatment of the Stark effect. Dissert. Abstr.

N71-14221 Illinois Univ., Urbana.
CURRENT OSCILLATIONS IN LONG Zn-DOPED Si p-i-n DIODES
Morley Matthews Blouke (Ph.D. Thesis) 1969 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-794

Long Zn-doped Si p-i-n diodes exhibit large amplitude, sinusoidal, current oscillations in the positive resistance position of the I-V characteristic. These oscillations occur in the temperature range from 150 K to 210 K. Over this temperature range, the frequency of oscillation varies nearly three orders of magnitude, from 1kHz to 1MHz. Preceding the oscillations, these devices exhibit two carrier, space charge limited conduction typical of long p-i-n diodes. This is interpreted in terms of the cube law injected plasma theory of Lampert and Rose. It is shown that the critical parameter for the initiation of the oscillations is the presence of a minimum free carrier concentration in the intrinsic region. The solid solubility of Zn in Si is extended nearly two orders of magnitude over that previously known, to include the temperature range 800 C to 1000 C. Dissert. Abstr.

N71-14311*# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
DESCRIBING RESULTS OF 4000 HOURS OF MULTI-ENVIRONMENT MODEL VERIFICATION TEST Final Report
J. W. Crowe and S. L. Webster Oct. 1970 53 p
(Contract NAS5-21027)
(NASA-CR-115801; P70-467) Avail: NTIS CSCL 09A

The categorization and formulation of stress and strength factors for semiconductor diodes were investigated to provide an improved rationale for prediction based on realistic mathematical models. A general model for the failure rate of diodes was first developed and then the values of all the specific constants and parameter values were determined for the 1N3600 general purpose diode. As a result of the above studies a multi-environment model test program was undertaken, including 4,000 hours on 700 diodes under combined stresses. At the conclusion of the 4,000 hours of test at maximum rated load and 100 C, with a total cumulative gamma radiation of 1.6 x 10 to the 8th power rads(Si) and programmed vibration of 10 g there resulted; only one catastrophic (intermittent open) diode failure, 5 degradation failures for recovery time out of specification, and 31 degradation failures for reverse current (leakage) beyond specification of 100 namp. Author

N71-14322# Technische Hogeschool, Eindhoven (Netherlands).
ELECTRICAL BEHAVIOUR OF DEFECTS AT A THERMALLY OXIDIZED SILICON SURFACE
Maurice Vincent Whelan (Ph.D. Thesis) 27 Oct. 1970 105 p refs
Avail: NTIS

The electrical nature of surface states caused by defects at and near an oxide-silicon interface is investigated. A so-called C-V method, developed to study the energy distribution and the density of surface states at an SiO2-Si interface, is used to study metal-oxide-silicon sandwiches; the method requires the formation of a space-charge region at the silicon surface. After establishing the presence of interface states and their distribution, the steady-state behavior of a silicon surface strongly disturbed by an applied dc voltage from its thermal equilibrium condition is considered. The minority current flow in the surface space-charge layer of a gated diode is also examined in some detail. Author

N71-14384* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
APPARATUS AND METHOD FOR SEPARATING A SEMICONDUCTOR WAFER Patent
Irving Litant and Anthony J. Scapicchio, inventors (to NASA) Issued 3 Feb. 1970 (Filed 5 May 1969) 5 p Cl. 225-2; Int. Cl. B26f3/00
(NASA-Case-ERC-10136; US-Patent-3,493,155; US-Patent-Appl-SN-821589) Avail: US Patent Office CSCL 09A

A method is described for separating flat wafers into chips

bounded by scribe lines and already containing microcircuits. The wafer is placed on a convex hemisphere; a flexible diaphragm is positioned over the wafer, and the whole is encompassed by a chamber. Fluid is introduced into the chamber above the diaphragm. As the fluid pressure is increased, the diaphragm forces the wafer onto the hemisphere, breaking the wafer into chips but holding the chips in place so they do not touch or slide over each other. The separation of the chips is clean and clear-cut, with minimum of flaks and dust formation. N.E.N.

N71-14482# Houston Univ., Tex.
CHARACTERISTIC SUBGROUPS OF LATTICE-ORDERED GROUPS
Richard D. Byrd, Paul Conrad, and Justin T. Lloyd [1970] 58 p refs Prepared in cooperation with Tulane Univ.
(Grant NSF GP-8999)
Avail: Issuing Activity

A convex l-subgroup C of an l-group G is called characteristic if Ct = C for each l-automorphism t of G. The characteristic subgroups of G are investigated, and various characteristically simple l-groups are constructed. Author

N71-14489# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
SUPERCONDUCTIVITY IN ELECTRICAL ENGINEERING [LA SUPERCONDUTTIVITA' NELL'ELETTROTECNICA]
G. Sacerdoti 4 Mar. 1970 64 p refs In ITALIAN
(LNF-70/5; Rept-464) Avail: AEC Depository Libraries

The preparation of superconductors for high field magnets is discussed with emphasis on the preparation of Nb3Sn, NbTi, NbZr, and V3Ga. The process of stabilization of these materials is considered with respect to quenching, degradation, training, H sub c (I sub c) curves, flux jumps, anomalies in the function I sub c (H sub c) and residual magnetic fields. The models of the transport mechanisms of currents in superconductors that permit qualitative interpretation of these phenomena are examined. The applications of superconductivity to superconductor cables, superconductor motors and generators, energy accumulators in superconductor magnetic devices, and superconductor magnets are examined. NSA

N71-14490# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
FORTRAN-PROGRAM FOR THE COMPUTATION OF THE SURFACE IMPEDANCE OF SUPERCONDUCTORS
J. Halbritter Jun. 1970 20 p refs
(NP-18355) Avail: AEC Depository Libraries

The FORTRAN program computes the surface impedance Z of superconductors in the Meissner state for frequencies lower than the energy gap. The formulas used are exact within the framework of the BCS theory for weak-coupling superconductors. Strong-coupling effects can be introduced and the temperature dependence of the gap parameter Delta(T) is approximated. Author (NSA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-14090* Aerojet-General Corp., El Monte, Calif.
AMMONIUM PERCHLORATE COMPOSITE PROPELLANT CONTAINING AN ORGANIC TRANSITIONAL METAL CHELATE CATALYTIC ADDITIVE Patent
Willfred G. Schmidt, inventor (to NASA) Issued 27 Jan. 1970 (Filed 11 Sep. 1968) 4 p Cl. 149-19; Int. Cl.C06b11/00
Sponsored by NASA
(NASA-Case-LAR-10173-1; US-Patent-3,492,176; US-Patent-Appl-SN-758942) Avail: US Patent Office CSCL 21I

Characteristics of metallic additives are discussed, and a copper-based additive which yields an accelerated burning rate is described. The composite propellant with the catalyst has a normal pressure slope up to 1000 to 1200 psi and a low pressure exponent from 1200 to 3000 psi. The ligands of the Cu(II) chelates have at least one basic nitrogen. N.E.N.

N71-14225*# Unidev, Inc., Huntsville, Ala.
ON THE MOTION OF LIQUIDS ENCLOSED IN AEROSPACE VEHICLE TANKS UNDER WEAK GRAVITATIONAL FIELDS. VOLUME 1: THEORETICAL CONSIDERATIONS
L. L. Fontenot Mar. 1970 110 p refs
(Contract NAS8-21272)
(NASA-CR-113117; UR-0001O-Vol-1) Avail: NTIS CSCL 21I

Using fundamentals from classical mechanics and hydrodynamics, the complete equations are derived for motion of aerospace vehicles with partially liquid filled cavities. The motions of the liquids in the tanks and their contributions to the overall vehicle motion are also defined. The fundamental equations are specialized to a reference state of motion in the form of constant linear accelerations and angular velocities. Then, the vehicle is slightly distributed from the known reference state motion and the resulting small motion of deviation obtained. Assuming that the surface tension is small in comparison with the effective mass forces, a method for determining the behavior of liquids enclosed in tanks is developed for a launch vehicle undergoing planar motion. Then, the equations are specialized to rotationally symmetric tanks, wherein the axis of symmetry coincides with the vehicle acceleration vector. Finally, the equations describing the behavior of liquids in rotationally symmetric vessels (including surface tension and contact angle effects) are cast in a form suitable for digital implementation. E.M.C.

N71-14226*# Unidev, Inc., Huntsville, Ala.
DIGITAL ANALYSIS OF LIQUID SLOSHING IN ROTATIONALLY SYMMETRIC TANKS UNDER WEAK GRAVITATIONAL FIELDS. VOLUME 2: COMPUTATIONAL APPLICATION
T. S. Chandler and L. L. Fontenot Mar. 1970 128 p refs
(Contract NAS8-21272)
(NASA-CR-111739; UR-0001-Vol-2) Avail: NTIS CSCL 20D

The digital computer program used to determine eigenfrequencies, eigenfunctions, forces, and moments for propellant sloshing in rotationally symmetric tanks under weak gravitational field is presented. Author

N71-14227*# General Dynamics/Convair, San Diego, Calif.
LOW GRAVITY PROPELLANT CONTROL USING CAPILLARY DEVICES IN LARGE SCALE CRYOGENIC VEHICLES, PHASE 2 Final Report, Jan. 1969–31 Jul. 1970
Aug. 1970 221 p refs
(Contract NAS8-21465)
(NASA-CR-102879; GDC-DDB70-008) Avail: NTIS CSCL 21I

A discussion of the fluid, thermal, experimental, and design information for the S-4C tank restart in orbit and the propellant transfer missions is given. Conclusions show that capillary devices are effective means of controlling propellant in large cryogenic vehicles. No conclusions were reached for the propellant transfer. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-14019*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF A 10 DEG CONICAL PLUG NOZZLE WITH VARIOUS PRIMARY FLAP AND NACELLE CONFIGURATIONS AT MACH NUMBERS FROM 0 TO 1.97

Douglas E. Harrington Washington Dec. 1970 49 p refs

(NASA-TM-X-2086; E-5698) Avail: NTIS CSCL 21H

A plug nozzle with a ratio of throat area to nacelle area of 0.23 was tested with full-length plug and several truncated plugs and at several secondary flow ratios. Internal expansion was varied by translation of a cylindrical secondary shroud. A nozzle gross thrust coefficient of 1.02 was obtained at Mach 1.97 at a supersonic cruise pressure ratio of 27 with a secondary weight-flow ratio of 4 percent. At subsonic cruise, nozzle gross thrust coefficient was sensitive to the design of the nacelle and primary nozzle flap. Author

N71-14033*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

FEASIBILITY OF OBTAINING HYPERVELOCITY ACCELERATION USING PROPELLANT LINED LAUNCH TUBES Final Report, 27 Sep. 1966 – 5 May 1970

Charles Rodenberger, Miles L. Sawyer, and Michael M. Tower 1 Oct. 1970 324 p refs

(Contract NAS9-6812)

(NASA-CR-108699) Avail: NTIS CSCL 21H

Investigated is the feasibility of a new concept to accelerate projectiles to hypervelocities by using an explosive lining inside a launch tube as a reservoir of high pressure gas that is released during passage of the projectile. The gas maintains a relatively constant base pressure on the projectile through a small amount of gas that travels with the projectile. New methods and techniques of applying an explosive lining to the inside of thick-walled tubes, measuring the velocity of projectiles, measuring the internal pressure-time characteristics and obtaining higher velocities from lined tubes than from unlined tubes are developed. Theoretical and experimental studies indicate that the lined-tube concept is not subject to the velocity limitations of the present light gas guns. The limiting factor for the lined-tube is the ignition and reaction rate of the explosive lining. Author

N71-14038*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DIGITAL COMPUTER PROGRAM FOR ANALYSIS OF CHUGGING INSTABILITIES

John R. Szuch Washington Dec. 1970 77 p refs

(NASA-TN-D-7026; E-5829) Avail: NTIS CSCL 21H

A digital program, designed to generate chugging stability limits for bipropellant rocket engines is described. The program computes combustion delays and other parameters required for solution of the characteristic equation. The equation is solved for critical values of the injector pressure drops and the chugging frequency. Stability limits are presented for a specified flox-methane engine system. Limits for throttling at constant mixture ratio and the effects of varying the injector geometry on stability are determined. Computer listings and typical printouts of results are presented. Author

N71-14043* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTROSTATIC ION ENGINE HAVING A PERMANENT MAGNETIC CIRCUIT Patent

Paul D. Reader and Harold R. Kaufman, inventors (to (NASA) Issued 8 Mar. 1966 (Filed 27 Sep. 1963) 6 p Cl. 60-35.5

(NASA-Case-XLE-01124; US-Patent-3,238,715; US-Patent-Appl-SN-312269) Avail: US Patent Office CSCL 21C

Considered is an electron bombardment ion engine having an improved structure for providing a magnetic field that has the shape and strength required for optimum efficiency of operation of the discharge. A permanent magnetic circuit is provided by a group of permanent magnets arranged with permeable paths to conduct and distribute the magnetic flux lines through the ion chamber; the required magnetic field is produced by the apparatus which is passive because after the magnets have been initially magnetized and placed into the circuit no further activation is required for proper operation. NASA

N71-14044* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PASSIVELY REGULATED WATER ELECTROLYSIS ROCKET ENGINE Patent

Daniel J. Grant, inventor (to NASA) Issued 20 Jan. 1970 (Filed 12 Sep. 1967) 4 p Cl. 60-200; Int. Cl. F02k7/08; Int. Cl. F02g3/00; Int. Cl. F02b43/12

(NASA-Case-XGS-08729; US-Patent-3,490,235; US-Patent-Appl-SN-667637) Avail: US Patent Office CSCL 21H

The invention comprises a water electrolysis rocket characterized by a single vessel storage and water electrolysis system, with the chamber divided into cathode and anode compartments having a volumetric ratio of 1.075:1. The compartments are vented to each other at a point below the electrolyte levels. The oxygen and hydrogen lines feed the gases through properly proportioned fixed plate orifices to the mixing chamber of a rocket engine in stoichiometric proportions. The geometry of the system makes it passively self-regulating. NASA

N71-14045*# AiResearch Mfg. Co., Los Angeles, Calif.

HYPERSONIC RESEARCH ENGINE PROJECT, PHASE 2. CATEGORY 1 TEST REPORT ON STRUT THERMAL PERFORMANCE AND THERMAL CYCLE TESTING

R. C. Chansler, ed. 3 Oct. 1969 107 p refs

(Contract NAS1-6686)

(NASA-CR-111812; AP-69-5547) Avail: NTIS CSCL 21E

Outlined are the procedures and results of tests conducted on full-scale struts of the Hypersonic Research Engine (HRE). The tests were designed to determine: (1) thermal performance and thermal fatigue resistance of the strut; (2) thermal performance and thermal fatigue resistance of the support panels which simulate the engine structural shells in the vicinity of the struts; and (3) coolant flow distribution. Author

N71-14046*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GASEOUS-HELIUM REQUIREMENTS FOR THE DISCHARGE OF LIQUID HYDROGEN FROM A 3.96-METER-(13 FT) DIAMETER SPHERICAL TANK

Robert J. Stochl, Joseph E. Maloy, Phillip A. Masters, and Richard L. De Witt Washington Dec. 1970 61 p refs

(NASA-TN-D-7019; E-5797) Avail: NTIS CSCL 20D

Determined were the effects of various physical parameters on the pressurant gas (gaseous helium) requirements during pressurization and expulsion of liquid hydrogen from a 3.96-meter-(13-ft-) diameter spherical tank. The experimental results were also compared with results predicted by a previously developed analytical program. The experimental results show that the inlet gas

temperature has a strong influence on the actual pressurant gas requirements. There is an average decrease in pressurant gas requirements of 1.0 percent for a 10 K (18 deg R) increase in inlet gas temperature. The analytical program was able to predict the actual pressurant requirements to within a maximum of 4.6 percent for all cases. Author

N71-14058* Marquardt Corp., Van Nuys, Calif.
FUEL INJECTION PUMP FOR INTERNAL COMBUSTION ENGINES Patent
John H. Danskin, inventor (to NASA) Issued 3 Feb. 1970 (Filed 10 Feb. 1969) 6 p Cl. 103-37; Int. Cl. F04b49/00, 19/02 Sponsored by NASA
(NASA-Case-MSC-12139-1; US-Patent-2,492,947; US-Patent-Appl-SN-797796) Avail: US Patent Office CSCL 13G

A variable displacement volume pump, with an axially reciprocating tubular displacement plunger having an axial through-bore, is described. Within the displacement plunger through-bore is a solid cylindrical volume control plunger which also reciprocates axially. The volume of the displacement plunger equals or exceeds the volume evacuated by the volume control plunger. The excess fluid is discharged from the pump cylinder past a check valve into a discharge conduit. The pump permits the quantity of fluid discharged to be rapidly and continuously adjusted, and is inexpensive and easily maintained, calibrated, and operated. N.E.N.

N71-14064*# Aerojet Liquid Rocket Co., Sacramento, Calif.
LOW COST TURBOPUMP STUDY, MANAGEMENT SUMMARY Final Report
M. W. Young and S. L. Sachs 17 Jul. 1970 40 p
(Contract NAS8-14859)
(NASA-CR-102923; ALRC-2100-4) Avail: NTIS CSCL 21H

Integral considerations were the mission, vehicle, engine trade-offs, detailed subcomponent analyses, and a half-size version of the multipurpose launch vehicle with a 500,000 lb payload capability to low earth orbit. Imposed study constraints of a LOX/LH2 propellant combination and a packaging arrangement with a bell nozzle, gas generator, and gimbal mount resulted in definite design characteristics for the base turbopump which where then used to generate reference conceptual designs for fuel and oxidizer turbopumps. Operational costs for these turbopumps provided basic data for synthesizing the design offering the lowest over-all cost. Data included cost and performance information in terms of identical variable requirements as well as turbopump performance information in relationship to vehicle and mission costs. Author

N71-14134*# Aerojet-General Corp., Sacramento, Calif. Nuclear Div.
EVALUATION OF TEST RESULTS FOR THIN-FILM PRESSURE TRANSDUCER: NERVA PROGRAM Final Report
E. R. Sita Sep. 1969 73 p refs
(Contract SNP-1)
(NASA-CR-111586; RN-S-529) Avail: NTIS CSCL 21F

Four, vapor-deposited, thin-film pressure transducers were irradiated in the ASTR 23/R512 test fixture, that simulated the NERVA engine mounted configuration. The test was conducted to determine the effects of gamma rate and neutron damage on the performance characteristics of the test transducers, with radiation levels in excess of anticipated full-power engine requirements. Several secondary experiments were included in the test. These experiments included evaluating the effect of a variable gamma flux on stainless-steel-sheathed magnesium-oxide insulated cables, of the type used with the transducers, and verification of the analytical thermal model of the transducer. It was found that generally, radiation induced changes in transducer characteristics are small. Significant changes are the gamma induced zero shift and the neutron threshold damage level. NSA

N71-14135*# Aerojet Liquid Rocket Co., Sacramento, Calif.
INVESTIGATION OF ADVANCED REGENERATIVE THRUST CHAMBER DESIGNS Final Report
V. R. Stubbs 15 Nov. 1970 88 p
(Contract NAS3-7971)
(NASA-CR-72742) Avail: NTIS CSCL 21H

A regeneratively cooled thrust chamber has been fabricated with a vapor deposited tungsten flame liner, a plasma sprayed tungsten-circonia thermal barrier, and an electroformed nickel coolant jacket with integrally formed coolant channels. The fabrication processes are described and illustrated. Additionally, off-design thermal analyses and startup and shutdown transient analyses are presented for a nominal 400 psia P sub c, 8000 lb thrust, F2/H2 engine. Author

N71-14188*# Translation Consultants, Ltd., Arlington, Va.
NEW MATERIALS AND NEW DESIGNS FOR AIRCRAFT TURBINE ENGINES [NOWE MATERIALY I NOWE FORMY KONSTRUKCYJNE LOTNICZA I AUSTRONAUTYCZNA]
J. Czapliski, et al Washington NASA Dec. 1970 15 p refs Transl. into ENGLISH from Tech. Lotnicza i Austronautyczna (Warsaw), v. 25, Jan. 1970 p 13-18
(Contract NASw-2038)
(NASA-TT-F-13398) Avail: NTIS CSCL 21E

Description of new trends in the development of new structural materials, and new concepts in the design of aircraft turbine engines. Special attention is given to the fiber-reinforced materials with metallic or resin matrices, and oxide dispersion hardened alloys. New design concepts involving the integral structures, fiber-reinforced composites and honeycomb structures are described. Author

N71-14199# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
RAMJET TECHNOLOGY. CHAPTER 11: HYPERSONIC RAMJETS
G. L. Dugger and F. S. Billig Mar. 1970 148 p refs
(Contract NOw-63-0604-c)
(PB-193911; APL-TG-610-11) Avail: NTIS CSCL 21E

The special problems associated with ramjets flying at hypersonic speeds are addressed, and the potentialities of ramjets using subsonic and supersonic ducted burning and external burning for the hypersonic flight regime are discussed and compared. Included are: theoretical approaches for treating boundary-layer, non-uniform-flow, and non-equilibrium effects; inlet efficiency parameters; leading edge problems (ablation, forced cooling, and drag considerations); performance of hypersonic inlets; theoretical analysis and experimental results on external burning for drag reduction and side-force production; theoretical descriptions of supersonic heat addition and a few experimental results; summaries of hypersonic airplane studies based on subsonic burning ramjets and turboramjets; and theoretical overall performance of supersonic combustion ramjet engines. Author (USGRDR)

N71-14348 California Univ., San Diego.
PERFORMANCE OPTIMIZATION OF A THERMIONIC NUCLEAR ELECTRIC PROPULSION SYSTEM FOR PLANETARY MISSIONS
Jacob Frank Ingber (Ph.D. Thesis) 1969 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-21309

The performance optimization of a thermionic nuclear electric propulsion system for planetary missions is discussed. A major objective of the analysis is to provide a method for estimating reactor power requirements as a guide to the development of a thermionic power source. The performance optimization is composed of the dual problem of electric vehicle sizing and low-thrust trajectory optimization. A technique is described for solving the

combined problem by effectively uncoupling the trajectory optimization and vehicle sizing providing a basis for easily computing optimum performance for a wide range of mission and system parameters. It is concluded that for preliminary design objectives, optimum trajectories for a given type mission need be computed only once to provide adequate performance information, regardless of parameter variations later introduced into the problem. Dissert. Abstr.

N71-14363*# Pratt and Whitney Aircraft, East Hartford, Conn.
SINGLE-STAGE EVALUATION OF HIGHLY-LOADED HIGH-MACH-NUMBER COMPRESSOR STAGES. 3: DATA AND PERFORMANCE TANDEM ROTOR
G. D. Burger and M. J. Keenan Jan. 1971 193 p refs
(Contract NAS3-10482)
(NASA-CR-72772; PWA-3954) Avail: NTIS CSCL 21E

A single-stage compressor with a 0.5 hub/tip ratio tandem rotor was designed to produce a pressure ratio of 1.936 at an efficiency of 84.2 percent. Rotor-tip speed was 1600 fps and flow rate was 187.1 lbs/sec. The design pressure ratio was obtained at design speed, with an efficiency of 83.1 percent and a flow of 177.8 lbs/sec. With radial inlet distortion, peak stage efficiency at design speed was 177.8 percent at a pressure ratio of 1.821 and a flow of 174.0 lbs/sec. With circumferentially distorted inlet flow, the peak stage efficiency was 74.4 percent at a flow of 165.7 lbs/sec and a pressure ratio of 1.766. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-13619# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information.
NATURE'S INVISIBLE RAYS – A WORLD OF THE ATOM SERIES BOOKLET
Jacob Kastner (Argonne Natl. Lab., Ill.) 1970 47 p refs
Avail: Issuing Activity

A textbook on the invisible radiation that occurs naturally on earth is presented. It is one in a series for junior high school science students and their teachers. The series describes the many exciting fields of nuclear energy. Author

N71-13628# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
MECHANISM OF RELATIVISTIC ELECTRON INJECTION IN CRAB NEBULA
I. S. Shklovski [1969] 3 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), no. 495, Feb. 1969 p 2–4
(CSIRO-Trans-10122) Avail: AEC Depository Libraries

The source of injection of relativistic particles in the Crab Nebula is postulated as being the pulsar within it. NSA

N71-14041*# General Electric Co., Philadelphia, Pa.
EXHIBIT A: STATEMENT OF WORK, PRINCIPAL INVESTIGATOR SERVICES FOR THE LUNAR SURFACE COSMIC RAY EXPERIMENT, ATTACHMENT 3
[1970] 8 p ref
Contract NAS9-11088)
(NASA-CR-108715) Avail: NTIS CSCL 04A

The purpose of this statement of work is to define those services to be performed by the principal investigators for the scientific support of the lunar surface cosmic ray experiment. These services pertain to the technical support required to develop the experiment hardware, the effort required to integrate the experiment into the Apollo program, and the support for the scientific analysis, interpretation, and reporting of the data obtained. Author

N71-14052*# General Electric Co., Philadelphia, Pa.
WORK STATEMENT FOR THE MANUFACTURE OF THE COSMIC RAY DETECTOR EXPERIMENT (5152), ATTACHMENT 2
[1970] 10 p refs
(Contract NAS9-11088)
(NASA-CR-108712) Avail: NTIS CSCL 18D

The purpose of this statement of work is to describe the deliverable products, and support services and their requirements to be furnished by the hardware contractor. The statement includes the design, development, fabrication, testing, and flight support of the cosmic ray detector experiment. Author

N71-14053*# General Electric Co., Philadelphia, Pa.
RELIABILITY PROGRAM REQUIREMENTS FOR COSMIC RAY DETECTOR EXPERIMENT (5152), ATTACHMENT 2, APPENDIX 2
[1970] 10 p refs
(Contract NAS9-11088)
(NASA-CR-108714) Avail: NTIS CSCL 04A

Reliability requirements are specified for the following: the reliability program plan; failure mode, effect, and criticality analysis and reporting; the design review program; testing and reliability evaluation and reporting; the limited life program; the materials programs; and reliability documentation requirements. E.C.

N71-14075*# California Univ., Berkeley. Lawrence Radiation Lab.
LONG-TIME BEHAVIOR OF ENERGETIC INNER-BELT PROTONS
Harry H. Heckman, Peter J. Lindstrom, and George H. Nakano (Lockheed Missiles and Space Co., Palo Alto, Calif.) Oct. 1969 27 p refs Presented at the IAGA Gen. Sci. Assembly, Madrid
(Contracts NAS9-5249; W-7405-eng-48)
(MASA-CR-111731; UCRL-19309; CONF-690941-1) Avail: NTIS CSCL 04B

Experimental results are presented on the temporal behavior, since late 1962, of low altitude trapped protons, $E > or = to 57$ MeV. These data are interpreted in terms of the time dependent continuity equation, using a source function that is empirically deduced from the data. The observed changes in the flux of 63-MeV protons between 1963 and mid-1969 are in agreement with those expected from solar cycle changes in the atmosphere. Preliminary calculations that include semiannual as well as solar cycle atmospheric density variations indicate that, beginning in 1967, semiannual changes in the 60 MeV proton flux should be observable at altitudes below about 350 km. The flux measurements are consistent with this computational result. Author (NSA)

N71-14127*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
DIRECT, DURABLE CAPTURE OF 1 TO 8 MeV SOLAR ALPHA PARTICLES INTO GEOMAGNETICALLY TRAPPED ORBITS
James A. Van Allen and Bruce A. Randall Jul. 1970 14 p refs
(Contract NAS1-8141; Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-111732; AD-711813; Rept-70-41) Avail: NTIS CSCL 04A

The report studies the hypothesis that the major, rapid increases in the intensity of durably trapped 1-8 MeV alpha particles are caused by the direct capture of solar particles from the interplanetary medium but that such capture is possible only during geomagnetic storms of appropriate, but as yet undefined, characteristics. Author (TAB)

N71-14166*# Stanford Univ., Calif. Inst. for Plasma Physics.
LONGITUDE DISTRIBUTION OF SOLAR FLARES
P. C. W. Fung (Hong Kong Univ.), P. A. Sturrock, P. Switzer, and G. Van Hoven (Calif. Univ.) Nov. 1970 23 p refs
(Grant NGL-05-020-272; Contract F44620-69-C-0008)
(NASA-CR-111735; SU-IPR-393) Avail: NTIS CSCL 03B

Statistical tests, based on the maximum likelihood method, were performed on flare series extending over several years. If all flares in each plage region are taken into account, a rich spectrum is obtained. If one carries out similar analysis of a reduced flare series, which includes at most one flare from each plage region, the spectrum is almost devoid of structure, and what structure does remain is not statistically significant. The inference is that solar activity does not display genuine rigid rotation modulation, but that repeated events from individual centers of activity yield modulation which may be mistaken for rigid rotation modulation. A test for correlation between reduced flare series for the northern and southern hemispheres gives no significant correlation. This test therefore yields no support to the hypothesis that solar activity is modulated by planetary effects. Author

N71-14236# Atomic Energy Commission, New York. Health and Safety Lab.
MEASUREMENTS OF COSMIC-RAY IONIZATION IN THE ATMOSPHERE, 1968–1970
P. D. Raft, W. M. Lowder, and H. L. Beck Aug. 1970 28 p refs
(HASL-234) Avail: NTIS

Balloon measurements of cosmic ray ionization and charged particle dose rate in the atmosphere were commenced in 1968 as an extension of the program of environmental radiation dosimetry at ground level. Argon-filled ionization chambers equipped with MOSFET electrometers and with various gas pressures and steel wall thicknesses were utilized. A study of their response in the laboratory and at altitude indicates that the free-air ionization profile in the atmosphere can be determined to an accuracy of + or − 5% (s.d.). Data from five flights between May 1969 and June 1970 at 53 and 42 N geomagnetic latitude provide ionization profiles consistent with HASL ground level results. The measured ionization (dose rate) at 53 N for 10,000, 35,000, and 65,000 ft are, respectively, 6.3 I(9.5 microradian/hr), 114 I(170 microradian/hr), and 290 I(436 microradian/hr). These results are approximately minimum values for the 11-year solar cycle. Author (NSA)

N71-14299# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
DIFFUSION AND ACCELERATION IN THE EARTH'S RADIATION BELTS
Carl-Gunne Faelthammar Jun. 1970 50 p refs Presented at the Intern. Symp. on Solar-Terrest. Phys., Leningrad, 11–16 May 1970
(Rept-70-17) Avail: NTIS

Diffusion and acceleration in the magnetosphere are important not only for solar-terrestrial relations but also for the study of low-density plasmas. This review deals with outer zone electron flux profiles, the radial variation of energy spectra, conservation of the first two adiabatic invariants and pitch-angle, and bimodal diffusion. ESRO

N71-14419*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
LOCKHEED EXPERIMENT ON ATS-5 Quarterly Progress Report, 1 Sept. – 30 Nov. 1970
30 Nov. 1970 23 p refs
(Contract NAS5-10392)
(NASA-CR-115779; QPR-5) Avail: NTIS CSCL 03B

The results of a series of simultaneous coordinated measurements of the low energy electrons on both ATS-5 and the low altitude polar orbiting satellite OV1-18 indicate significant spectral differences between the two locations. A detailed examination of the quasi-periodic oscillations of the particle fluxes and magnetic field, as measured on ATS-5 during a Pc-5 micropulsation event has been performed. A comparison with rapid run magnetograms from both northern and southern hemisphere conjugate stations is illustrated. Author

N71-14422 Pittsburgh Univ., Pa.
ROCKET INVESTIGATION OF THE AURORA BOREALIS: SOME OF ITS PROMINENT OPTICAL FEATURES AND ITS ION COMPOSITION
Truman David Parkinson (Ph.D. Thesis) 1969 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-19675

Analysis of data from a series of three sophisticated Aerobee rocket experiments flown into auroral displays has yielded much information concerning the excitation mechanisms of several optical emissions. Laboratory measured cross sections for the N(+) (O-O) first negative band, its observed volume emission rate, and measured secondary electron spectra allow calculation of the electron fluxes responsible for the N2 first positive bands, the O(+) first negative bands, and the OI green line at 5577A. The molecular emissions can be accounted for in terms of direct electron impact excitation from the appropriate neutral molecule. The classical source of the green line, direct electron impact excitation of O, is shown inadequate. Dissert. Abstr.

N71-14444# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
SMALL ANGULAR SIZE SOURCE IN CRAB NEBULA
L. I. Matveenko et al Feb. 1969 2 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), no. 495, Feb. 1969 p 1–2
(CSIRO-Trans-10121) Avail: AEC Depository Libraries

The distance to a pulsar in the direction of the Crab Nebula was evaluated from polarization investigations, and it was verified as being in the Nebula. The anomaly of the sizes of the flickering source, compared with the angular size of a neutron star at this distance, is explained by the model of a rotating neutron star radiating in a comparatively small cone. Author (NSA)

N71-14459# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
PULSAR CP0808 METRE WAVELENGTH RADIATION
Yu. I. Alekseev, V. V. Vitkevch, and Yu. P. Shitov 5 Feb. 1969 2 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), no. 495, Feb. 1969 p 4–5
(CSIRO-Trans-10123(Avail: AEC Depository Libraries

Results of observations of CP 0808 indicated 3 subpulses at 82 Mc/s and 2 subpulses at 80 Mc/s. The period mean value was 0.05364 + or − 0.00001 sec. Frequency drift at 81.5 Mc/s was 11.42 Mc/s, which conflicts with some previously cited data. Author (NSA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-13584# Lowell Observatory, Flagstaff, Ariz.
LOWELL PROPER MOTIONS 14
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 9 Dec. 1969 16 p refs Supported in part by NSF *Its* Bull. 151, Vol. 7, No. 14, p 149–164
Avail: Issuing Activity

A program of direct measurement of proper motions from 13-inch photographic telescope plates having an epoch difference of thirty years has been in progress since 1957. The detailed description of the procedure adopted and lists of 13996 stars with motions > or = to 0.27 sec/year are contained in Lowell Observatory Bulletin Nos. 89, 102, 112, 120, 122, 124, 129, 132, 136, 138, 140, 144 and 150. Additional objects with motions < 0.27 sec/year which were found to have blue colors were published in Lowell Bulletin No. 125 and No. 141 as white dwarf suspects. The data from regions G246 through G255 inclusive are given. Because the plate overlap in these northern regions is large in the upper corners where the measures are less accurate, a reasonable overlap of over one degree has been marked, and only the center of the plate was blink examined. The percentage of the usual plate that was blinked for each region is tabulated. Author

N71-13585# Lowell Observatory, Flagstaff, Ariz.
LOWER PROPER MOTIONS 15
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 30 Jul. 1970 30 p refs 152, VOL. 7, No. 15, p 165–182 p 165–182
Avail: Issuing Activity

A program of direct measurement of proper motions from 13-inch photographic telescope plates having an epoch difference of thirty years has been in progress since 1957. The detailed description of the procedure adopted and lists of 14,520 stars with motions > or = to 0.27 sec/year are contained in Lowell Observatory Bulletin Nos. 89, 102, 112, 120, 122, 124, 129, 132, 136, 138, 140, 144, 150, and 151. Additional objects with motions < 0.27 sec/year which were found to have blue colors were published in Lowell Bulletin Nos. 125, 141 and 153 as white dwarf suspects. The data from regions G256 through G265 inclusive are given, which completes the survey in the Northern Hemisphere. Because the plate overlap in these northern regions is large in the upper corners where the measures are less accurate, a reasonable overlap of over one degree has been marked, and only the center of the plate was blink examined. The percentage of the usual plate that was blinked for each region is tabulated. Author

N71-13586*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
POLARIZATION MEASUREMENTS OF THE GALILEAN SATELLITES OF JUPITER
J. Veverka [1970] 14 p refs
(Grant NGR-33-010-082)
(NASA-CR-115783; CRSR-409) Avail: NTIS CSCL 03B

Polarization curves for the four Galilean satellites are presented. They indicate that the surfaces of Io, Ganymede, and Europa are covered mostly by a bright, transparent material, possibly frost. The surface of Callisto is different. It is more similar to that of the Moon, but some frost patches are also present. Author

N71-13589*# Arizona Univ., Tucson. Lunar and Planetary Lab.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 8, PART 3
G. P. Kuiper, W. K. Hartmann, and Barbara Vigil, eds. 1970 80 p refs Sponsored in part by NASA and NSF *Its* Commun. No. 142-148
(NASA-CR-115785) Avail: NTIS CSCL 03B

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7. MARS: 1967 PHOTOGRAPHIC MAP S. Larson p 197–201 refs (See N71-13596 04-30)

N71-13590*# Arizona Univ., Tucson.
HIGH ALTITUDE SITES AND IR ASTRONOMY
Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 3 1970 p 121–164 refs (See N71-13589 04-30)
Avail: NTIS CSCL 03B

A reconnaissance is made of the comparative suitability of several U.S. mountain sites for IR astronomical observations. The text develops some general criteria for intercomparison. The immense importance of a reduction in the water-vapor content is shown. It is concluded that two types of sites can contribute: (1) dry sites at intermediate level, safe for manned scientific operations, allowing ready access, having IR and/or microwave facilities; and (2) the driest site(s) on which part-time manned operations are feasible (14,000-18,000 ft.), used during optimum conditions, in part by remote control from a laboratory-base some 5,000 ft. lower, and in part directly. The type-2 site needs cable car or aircraft transportation from the laboratory-base to the observatory. Airborne IR facilities are the third step in avoiding telluric absorptions. Studies are still needed for several potential sites on modes of access, frost points, cloud cover, and frequency of destructive winds. The requirements of an IR observatory are developed including ways of reducing anoxemia; they differ from those of traditional optical observatories. Selected sites are described with additional information given in the appendices. Author

N71-13591*# Arizona Univ., Tucson.
THE PLANET MERCURY: SUMMARY OF PRESENT KNOWLEDGE
Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 3 1970 p 165–174 refs Presented at Calif. Inst. of Tech Mercury Symp., 4 Feb. 1970 (See N71-13589 04-30)
Avail: NTIS CSCL 03B

Present knowledge is collected on the Mercury orbit, diameter, mass, density, rotation, surface features, atmosphere, polarization, albedo, and color. Comments are presented on problems that may be solved from image resolutions of about 1 km. Author

N71-13592*# Arizona Univ., Tucson.
THE ORBIT OF COMET BESTER 1946K - 1947I
G. Van Biesbroeck *In its* Commun. of the Lunar and Planetary

Lab., Vol. 8, Part 3, 1970 p 175–178 refs (See N71-13589 04-30)
(Grant NSF GP-3785)
Avail: NTIS CSCL 03B

A discussion of the 118 measures of this comet, covering an interval of 700 days, led to a final near-parabolic orbit with a slight hyperbolic excess of eccentricity. Both the original and future orbits turn out to be long-period ellipses with a period of the order of one million years. Author

N71-13593*# Arizona Univ., Tucson.
MEASURES OF THE SATELLITES OF URANUS AND MARS
G. Van Biesbroeck *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 3 1970 p 179–188 (See N71-13589 04-30)
(Grant NSF GP-6615)
Avail: NTIS CSCL 03B

Relative measures are made of the satellites of Uranus and Mars, from plates taken with the 82-inch McDonald Observatory reflector telescope, and the 61-inch NASA telescope at the Catalina Observatory. Author

N71-13594*# Arizona Univ., Tucson.
THE ORBIT OF COMET BURNHAM-SLAUGHTER 1958e - 1959I
G. Van Biesbroeck *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 3 1970 p 189–191 refs (See N71-13589 04-30)
(Grant NSF GP-11177)
Avail: NTIS CSCL 03B

Using 94 observations covering an interval of 592 days, a preliminary set of parabolic elements was improved differentially, taking into account the perturbations by all the planets from Venus to Neptune. The final solution yields a very nearly parabolic ellipse. Backward and forward computations of the perturbations over 20 year intervals show that the comet is a permanent member of the solar system. Author

N71-13595*# Arizona Univ., Tucson.
THE ORBIT OF COMET HUMASON 1960e - 1959X
G. Van Biesbroeck *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 3 1970 p 193–195 refs (See N71-13589 04-30)
(Grant NSF GP-6615)
Avail: NTIS CSCL 03B

Preliminary elements of this distant, faint comet were differentially corrected using 34 measures covering a period of 349 days. The orbit comes out very slightly hyperbolic but backward and forward computations show that the comet is a permanent member of the solar system. Author

N71-13596*# Arizona Univ., Tucson.
MARS: 1967 PHOTOGRAPHIC MAP
Stephen Larson *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 3 1970 p 197–201 refs (See N71-13589 04-30)
(Grant NGL-03-002-002)
Avail: NTIS CSCL 03B

A map of Mars was constructed based on photographs taken with the 154 cm NASA telescope of the Catalina Observatory from March 15 to May 20, 1967. Photographs covering 6000 to 8900 A were used to optimize seeing and minimize the reduction of contrast by the Martian atmosphere Author

N71-13620*# Rice Univ., Houston, Tex. Dept. of Space Science.
INVESTIGATION OF BRIGHT SOURCES OF LONG-WAVE INFRARED RADIATION Semiannual Technical Report
Frank J. Low, H. H. Aumann, and Carlton M. Gillespie, Jr. 1 Dec. 1969 29 p refs Sponsored in part by NASA
(Contract F19628-69-C-0302; ARPA Order 1366)
(NASA-CR-115780; AD-712086; AFCRL-70-0327; SATR-1) Avail: NTIS CSCL 03A

The Flying Infrared Telescope is described with particular reference to its mechanical and optical design. A program plan is outlined whereby this airborne telescope may be used to support a ground-based far infrared survey instrument in the acquisition of information on the number and spacial distribution of astronomical LWIR sources. Author (TAB)

N71-13621# Congress. House. Committee on Science and Astronautics.
THE NATIONAL SPACE PROGRAM: PRESENT AND FUTURE A COMPILATION OF PAPERS PREPARED FOR THE SUBCOMMITTEE ON NASA OVERSIGHT
Washington GPO 1970 250 p refs Presented to the Comm. on Sci. and Astronaut., 91st Congr., 2d Sess., 10 Dec. 1970 *Its* Serial U
Avail: SOD $1.00

The Subcommittee on NASA Oversight of the House Committee on Science and Astronautics scheduled public hearings for September and October 1970. The subcommittee proposed to explore what should be the objectives of our national space program during the next decade, and the level of funding that would be needed to support a program calculated to achieve those objectives. Distinguished representatives from Government, the aerospace industry, and the academic community were invited to participate. Due to the press of legislative business, and the uncertain status of the NASA appropriation measure for fiscal year 1971 because of the President's veto, the hearings were canceled. Nevertheless, the views of the scheduled witnesses were considered to be of such interest and significance under present circumstances that they were asked to submit their statements for review and publication. Author

N71-13742*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 12 LUNAR-SAMPLE INFORMATION
Jeffrey Warner, comp. Washington Dec. 1970 391 p ref
(NASA-TR-R-353; MSC-S-243) Avail: NTIS CSCL 03B

Scientific data obtained during the preliminary examination of the lunar samples returned from the Apollo 12 mission are presented. The sample collecting tools and techniques; and the contingency, selected, documented, and tote-bag samples are described. A preliminary search was conducted to determine the lunar-surface location and orientation of each sample, and the results are discussed. The results of the various chemical and isotopic analyses are given. Photographs and mineralogical/petrological descriptions of the samples, plots and descriptions of the controls and samples subjected to organic analyses, details of the organic-contamination monitors and controls, and an index of the photographic documentation both on the lunar surface and in the Lunar Receiving Laboratory are included in the report. Author

N71-13744# Australian National Univ., Canberra.
HOT EXTREME POPULATION II STARS
Edward B. Newell (Ph.D. Thesis) 1969 250 p refs
(NP-18375) Avail: AEC Depository Libraries

Atmospheric parameters, effective temperature, and surface gravity were determined for a number of hot, predominantly blue horizontal-branch (BHB) stars, that are members of the globular cluster and galactic halo population. Observation, using narrow-band interference filters, and low-dispersion image-tube spectrographs, indicated that the BHB stars in the globular clusters NGC 6397,

omega Centauri, M15, M13, M92, M3, and M4 have similar ranges of surface gravity and effective temperature. Log (M/L) = −2.0 + or − 0.1 for these clusters. The similarity of the BHB stars in clusters that exhibit a range of metal abundance can be interpreted as evidence for variations in the BHB helium abundance or mass, or both. A group of stars, believed to be disk horizontal-branch stars, was discovered, resembling those occupying the horizontal branch of galactic cluster M67. NSA

N71-13762*# Bellcomm, Inc., Washington, D.C.
MASS DISTRIBUTION OF ASTEROIDS
J. S. Dohannyi 1 Dec. 1970 37 p refs
(Contract NASw-417)
(NASA-CR-11138; TM-70-2015-6) Avail: NTIS CSCL 03B

As a result of frequent mutual collisions, the mass distribution of asteroids undergoes constant change. Nonetheless, for an arbitrary range of asteroid masses, the distribution can be faithfully represented by solving a steady state approximation of the stochastic equation for the evolution of the asteroid population. For such a mass range a power law, with index approximately 11/6 is shown to be unique, the only term left of a convergent power series expansion solving the steady state equation. The approximate steady state solution fails for the largest asteroids: these are broken up by collisions without being replenished. For asteroids in this mass range, an approximate time dependent solution is obtained, which asymptotically approaches the solution valid for the lower mass range. This solution is sensitive to the comminution law for collisional fragments which is assumed to be similar to that derived from laboratory experiments with semi-infinite basalt targets, impacted by high velocity projectiles. Author

N71-13861# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
SPIRAL ARMS OF GALAXIES ARE THE REGION OF SOLID-BODY ROTATION
B. A. Vorontsov-Velyaminov [1970] 3 p refs Transl. into ENGLISH from Astron. Tsirkuliar Akad. Nauk SSSR (Kazan), no. 495, Feb. 1969 p 6–7
(CSIRO-Trans-10124) Avail: AEC Depository Libraries

Evidence for the confirmation of solid-body rotation of spiral arms of galaxies is presented. Spiral structure is considered independent of the direction of rotation. NSA

N71-14005*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE LIBRATION OF A GRAVITY GRADIENT STABILIZED SPACECRAFT IN AN ECCENTRIC ORBIT
Albert J. Fleig, Jr. Washington Nov. 1970 133 p refs
(NASA-TR-R-350; G-982) Avail: NTIS CSCL 22A

General analytical methods for predicting planar and three dimensional attitude motion of a gravity gradient spacecraft in an elliptical orbit are developed. Regions of stability from the linearized planar equation of Mathieu form are plotted versus inertia parameters and orbit eccentricity. Similar plots showing the effects of damping are presented. The planar equation for larger eccentricities is examined with asymptotic expansion methods (KBM) for increased accuracy. An analysis based on the Hamiltonian and using cannonical transformations and the method of averaging is applied to the three degree of freedom equations, applied to the three degree of freedom equations. Thirty-two combinations of resonant eigenfrequencies, indicating both nonlinear and parametric resonances, and including six previously shown by Breakwell and Pringle, are found. Nineteen of these combinations lead to unbounded increases in the amplitude of oscillation of one or more of the spacecraft modes. Eight lead to significant interchanges of energy between modes. The remaining five have little effect. Author

N71-14067*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
NOMOLOGY OF EARTH-MOON ORBITS C = 4.00 AND C = C(L1)
R. F. Hoelker Washington Dec. 1970 80 p refs
(NASA-TN-D-5949; C-130) Avail: NTIS CSCL 03B

This volume is intended to begin to generate a classifying survey of the orbits of the earth–moon field. The mathematical representation of the problem is done by the restricted problem of three bodies with a mass ratio mu of 1/80. Orbits are generated by computational means and represented in their geometry in pictorial form. The series is arranged according to descending values of the Jacobi integration constant C which procedure is in agreement with the first line ordering applied to the body of E-M orbits. Further breakdowns of the orbit classes are made according to geometrical regions and the directions of motion. This volume covers the orbits on the C-levels of C = 4.00 and C = 3.20388, the latter of which closely corresponds to that of the cis-lunar equilibrium point L sub 1. Author

N71-14068*# California Univ., Berkeley. Space Sciences Lab.
LUNAR SURFACE ENGINEERING PROPERTIES EXPERIMENT DEFINITION. VOLUME 4: FLUID CONDUCTIVITY OF LUNAR SURFACE MATERIALS Final Report, 20 Jun. 1968 –19 Jul. 1969
Paul A. Witherspoon and D. Roger Willis Jan. 1970 38 p refs /its Ser. 11, Issue 13
(Contract NAS8-21432)
(NASA-CR-102842) Avail: NTIS CSCL 03B

A surface probe was designed and tested for measuring the permeability of lunar soils and rocks in situ. A theory of gas flow in porous media and experiments designed to test the theory are examined. E.H.W.

N71-14088*# Bell Bros. Research Corp., Boulder, Colo. Attitude Sensors Section.
ERROR STUDY FOR SS-1080 ATM SENSOR SYSTEM Final Report
C. E. Roos 12 Nov. 1970 152 p ref
(Contract NAS8-26280)
(NASA-CR-102957) Avail: NTIS CSCL 03B

An analytic study was conducted to determine the effects of atmospheric refraction and attenuation, and earth albedo on the ATM acquisition sun sensor during certain modes of operation. The results of the study are presented as follows: (1) The worst pointing error attributable to earth albedo in the sun pointing mode is 34 arc-seconds. (2) Misalignments due to atmospheric refraction can reach one degree, but presumably the ATM fine sun sensor will be effected to the same extent. At this point the sunlight is attenuated 94%. (3) In the event that a random search is performed to reacquire the sun, the acquisition sun sensor will generate no more than + or − 1.2 volts (10% of maximum output) as it scans across the earth. The output of the sun presence detector will not exceed 1.5% of its maximum value, which is far below the 50% point at which trigger levels were set. Use was made of an existing SSRC computer program. E.M.C.

N71-14107*# Lockheed Missiles and Space Co., Huntsville, Ala.
TRAJECTORIES FOR THE 1976 – 1980 GRAND TOUR OPPORTUNITIES. VOLUME 3: TRAJECTORY DATA FOR ALTERNATE GRAND TOUR MISSIONS
J. D. Perrott and R. S. Pimm Oct. 1970 382 p
(Contract NAS8-20082)
(NASA-CR-61338) Avail: NTIS CSCL 22A

A close encounter with a planet on a flyby trajectory has the effect of a propulsive maneuver resulting in an increase or decrease of energy, and/or a plane change of the heliocentric

trajectory. Data are presented for swingby missions to the Jovian planets of Jupiter-Saturn-Pluto and Jupiter-Uranus-Neptune. These missions are referred to as alternate Grand Tour missions as opposed to a normal Grand Tour mission which encounters the planets Jupiter, Saturn, Uranus, and Neptune. The Earth launch opportunities considered are for the time period 1976 to 1980. Trajectory data for alternate Grand Tour missions from earth during this period are tabulated. Author

N71-14113*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMBINED X-RAY NEUTRON EXPERIMENT FOR THE EXPLORATION OF LUNAR AND PLANETARY SURFACES

J. I. Trombka, I. Adler, and R. Schmadebeck Nov. 1970 24 p refs Submitted for publication

(NASA-TM-X-65394; X-641-70-420) Avail: NTIS CSCL 22A

A combined X-ray fluorescence and neutron excitation experiment for obtaining rapid surface and subsurface element analysis is presently under investigation. The X-ray experiment utilizes both alpha and beta sources; the neutron experiment utilizes isotopic or accelerator neutron sources. The X-ray system samples element composition to micron depths, whereas the neutron method measures element composition to approximately 2 feet in depth. Differences in element composition for the two measurements may reveal the time scale of processes involved in the formation of the planetary surfaces. Measurements with the X-ray and neutron sources have been carried out, and quantitative and semiquantitative results have been obtained. A preliminary design of a combined system has been completed and is presently under construction. Author

N71-14124*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A REVIEW OF NASA MINITRACK DATA TIME-TAGGING

William M. Rice Nov. 1970 26 p refs Submitted for publication

(NASA-TM-X-65391; X-551-70-41) Avail: NTIS CSCL 22A

The minitrack tracking stations measure an analog of direction cosines in units called minitrack counts. These counts are the scaled phase differences between corresponding points of the wave fronts arriving at the two antenna arrays comprising the given baseline. The process for generating minitrack counts is examined and the time for proper time-tagging of the count value is identified. Author

N71-14126*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE MAGNETIC FIELD GEOMETRY OF JUPITER AND ITS RELATION TO Io MODULATED JOVIAN DECAMETRIC RADIO EMISSION

Kenneth H. Schatten and Norman F. Ness Aug. 1970 31 p refs Submitted for publication

(NASA-TM-X-65397; X-692-70-431) Avail: NTIS CSCL 03B

Observations of the Io modulated Jovian decametric radio emission were compared with calculations of the magnetic field line passing through Io. Calculations of the angle between the earth and the magnetic field line near Io and both the northern and southern foot points of that field line with the surface of the planet were undertaken. Four emission sources favorable for synchrotron emission were located by presuming the earth-north (or south) threaded field intersection angle was near 90 degrees and the declination of Io was positive. These four sources correspond closely to the three major observed emission regions and to one infrequently observed. These calculations imply little distortion of the Jovian magnetic field by Io. A mechanism by which Io could stimulate the emission is presented that is consistent with the calculations conducted. Author

N71-14149# Joint Inst. for Lab. Astrophysics, Boulder, Colo.

SPECTRUM FORMATION WITHOUT THE HYPOTHESIS OF LTE: PHYSICAL PRINCIPLES

Richard N. Thomas 25 Nov. 1970 28 p refs

(JILA-106) Avail: Issuing Activity

A step-by-step summary is given of the physical principles introduced in discussing the spectrum of radiation produced by a stellar atmosphere. Spectrum formation represents the interaction between energy states of matter and of radiation field as the radiation diffuses outward through the stellar atmosphere. Such interaction is described by the ratio of emissivity to absorptivity of the gas. The general structure of the source function is discussed in terms of energy states of matter, their interaction among themselves and with the radiation field, and the use of population and transport equations. Author

N71-14152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPACE PROGRAMS SUMMARY NO. 37-65, VOLUME 1 FOR THE PERIOD 1 JULY–31 AUGUST 1970. FLIGHT PROJECTS

30 Sep. 1970 74 p refs

(Contract NAS7-100)

(NASA-CR-115773; JPL-SPS-37-65-Vol-1) Copyright. Avail: NTIS CSCL 22A

The primary objective of the Mariner Mars 1971 Project is to place two spacecraft in orbit around Mars that will be used to perform scientific experiments directed toward achieving a better understanding of the physical characteristics of that planet. Principal among these experiments are measurements of atmospheric and surface parameters at various times and locations to determine the dynamic characteristics of the planet. Approximately 70% of the Martian surface will be observed during a minimum of 90 days of orbital operations. Author

N71-14179*# Bellcomm, Inc., Washington, D.C.

THERMAL RADIATION EFFECT ON THE GENERAL CIRCULATION OF THE VENUS ATMOSPHERE

T. T. J. Yeh 14 Oct. 1970 37 p refs

(Contract NASw-417)

(NASA-CR-111736; TM-70-2015-4) Avail: NTIS CSCL 03B

The effect of thermal radiation on the general circulation of the Venus atmosphere is studied by using a grey gas approximation. A parametric study is performed for various values of optical thickness and the Boltzmann number, the latter parameter providing a measure of the relative importance of conductive and radiative processes in the flow of energy. The results show that for a fixed optical thickness, the magnitude of the wind velocity in general increases with decreasing Boltzmann number. For a fixed Boltzmann number, the maximum magnitudes of the wind velocity occur when the optical thickness is of order unity. This can be explained by the maximal integrated effect of radiation associated with unit optical thickness. Thus, for optical thickness of order unity and small Boltzmann number, the wind velocity and its kinetic energy may be substantially increased as compared with the case without radiation. The temperature perturbation, on the other hand, is not significantly affected for the cases studied. Author

N71-14194# Joint Publications Research Service, Washington, D.C.

THE STUDY OF LARGE SYSTEMS

Y. G. Markov 17 Nov. 1970 6 p refs Transl. into ENGLISH from Large Systems and the Systems Approach, Priroda (Moscow), no. 10, 1970 p 9–11

(JPRS-51802) Avail: NTIS

The development of analytical and synthetic methods for large systems is discussed along with applications of the theory of automatons. Author

N71-14230*# Texas Univ., Dallas.
HIGH-SENSITIVITY MINIATURIZED MAGNETIC SECTOR MASS SPECTROMETER FOR THE ALSEP PROGRAM Final Report
F. S. Johnson 3 Jun. 1970 157 p
(Contract NAS9-7591)
(NASA-CR-114774) Avail: NTIS CSCL 03B

The test results and status in the development of the Lunar ALSEP mass spectrometer for measuring the composition of the lunar atmosphere from the lunar surface are presented. The magnetic deflection mass spectrometer capable of withstanding the lunar environment is described which was developed with a dual filament ion source, and three ion counting detector systems which measure simultaneously the concentration of ambient atmospheric gases. F.O.S.

N71-14233*# TRW Systems Group, Houston, Tex. Electronics Systems Lab.
PERFORMANCE VERIFICATION OF THE LUNAR DESCENT PROGRAM: P66 AUTO, TASK E-72C
N. P. Dwivedi 30 Oct. 1970 71 p refs
(Contract NAS9-8166)
(NASA-CR-114787; TRW-17618-H044-R0-00) Avail: NTIS CSCL 22A

The results of simulated runs to evaluate the LM descent performance of the P66 automatic control and guidance system under stringent condition are presented. The objectives of the seven runs were: (1) a nominal run to provide a baseline for comparison; (2) four runs to stress the system by ROD exercise, velocity errros, and target redesignations; and (3) two runs to test the result of removing a certain nonlinearity in the throttle command computation under nominal conditions and subsequent ROD exercise. F.O.S.

N71-14287# Geological Survey, Washington, D.C.
BIBLIOGRAPHY OF THE LUNAR SURFACE Final Report
Jacquelyn H. Freeberg Sep. 1970 347 p refs
(PB-194206; USGS-GD-70-002) Avail: NTIS CSCL 03A

References in the bibliography are divided into two listings: (1) surface features and materials; and (2) telescope observations. The former is accompanied by a subject index, the latter by a locality index. Author (USGRDR)

N71-14367# Lowell Observatory, Flagstaff, Ariz.
A LIST OF WHITE DWARF SUSPECTS 3
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 30 Jun. 1970 30 p refs Supported in part by NSF *Its* Bull. 153, Vol. 7, No. 16, p 183–189
Avail: Issuing Activity

During the course of the regular Lowell proper motion survey program, many stars with motions smaller than the adopted lower limit of 0.27 second/year are marked. When the estimates of color are made, the very blue stars are easily identified. The list contains the white dwarf suspects from plate regions 225 through 265, all with proper motion less than 0.27 second/year and fainter than the eighth magnitude. It covers the regions from +50 deg to the north pole. Author

N71-14439*# Arizona Univ., Tucson. Lunar and Planetary Lab.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 8, PART 4
Gerard P. Kuiper, W. K. Hartmann, and Barbara Vigil, eds. 1970 124 p refs Sponsored by NASA *Its* Commun. No. 149-152
(NASA-CR-115784) Avail: NTIS CSCL 03B

CONTENTS:

1. THE NORTHEAST RIM OF TYCHO R. J. Turner p 203–234 ref (See N71-14440 04-30)

2. MULTIPHASE ERUPTIONS ASSOCIATED WITH THE LUNAR CRATERS TYCHO AND ARISTARCHUS G. Fielder (Lancaster Univ.) and R. G. Strom p 235–288 refs (See N71-14441 04-30)

3. BASALT MELTS IN A SIMULATED LUNAR ENVIRONMENT A. W. Hatheway p 289–298 refs (See N71-14442 04-30)

4. BANDERA LAVA TUBES OF NEW MEXICO, AND LUNAR IMPLICATIONS A. W. Hatheway and A. K. Herring p 299–327 refs (See N71-14443 04-13)

N71-14440*# Arizona Univ., Tucson.
THE NORTHEAST RIM OF TYCHO
Ralph J. Turner *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 4 1970 p 203–234 ref (See N71-14439 04-30)
Avail: NTIS CSCL 08E

The construction and interpretation of a scale relief model of the NE rim of Tycho are described. The model was measured with a special device yielding a total of over 150,000 relief points, from which a topographic map was derived having 20-meter contour intervals. The topographic map is included with a relief contour map to assist in the interpretation of the photographic records. The model area covers 450 sq km of lunar highland. Lava lakes are found at various elevations, ranging over 2000 meters, and in some cases the lakes are interconnected with slope angles varying from 0 deg to 36 deg. Impact craters are few in number. The rim of Tycho and two rough-textured hills have above average albedos. The several closely spaced, large, level lakes, among otherwise steep and rough terrain, would seem to provide favorable landing sites adjacent to very interesting highland areas. E.M.C.

N71-14441*# Arizona Univ., Tucson. Lunar and Planetary Lab.
MULTIPHASE ERUPTIONS ASSOCIATED WITH THE LUNAR CRATERS TYCHO AND ARISTARCHUS
Robert G. Strom and Gilbert Fielder (Lancaster Univ.) *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 4 1970 p 235–288 refs Revised (See N71-14439 04-30)
Avail: NTIS CSCL 03B

Photographs of Tycho and Aristarchus and their immediate surroundings, taken by Orbiter 4 and 5 with a ground resolution of 5 to 40 m, are studied in considerable detail. Many flow units that are intimately associated with these craters are presented. It is concluded that extensive flows issued from the inner and outer rims of both craters originated at distances of the order of 100 km from the rim crest. The morphology, sources, and temporal relationships of these flows indicate that they are volcanic lava flows. It is further suggested that, based on these observations, at least one class of lunar volcano resembles an impact crater. E.M.C.

N71-14442*# Arizona Univ., Tucson.
BASALT MELTS IN A SIMULATED LUNAR ENVIRONMENT
Allen W. Hatheway *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Part 4 1970 p 289–298 refs (See N71-14439 04-30)
(Grant NsG-161-61)
Avail: NTIS CSCL 03B

Hawaiian basalt samples were melted and partially outgassed in vacuo in order to obtain a material comparable to that extruded onto the lunar surface. Surface characteristics, internal structure, and bearing strength are described. Densities averaging 0.22 gm/cu cm and bearing strengths as high as 9 kg/sq cm were encountered. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-14082*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.

STUDY OF LOW GRAVITY PROPELLANT TRANSFER Quarterly Progress Report, 23 Jun. – 22 Sep 1970

J. A. Stark 28 Sep. 1970 50 p refs

(Contract NAS8-26236)

(NASA-CR-102843; GDC-584-4-549; QPR-1) Avail: NTIS CSCL 22A

Progress is reported on an analytical assessment of potential methods for replenishing the auxiliary propulsion, fuel cell, and life support cryogens aboard an orbiting space station. In terms of supply storage the systems considered are high pressure (storage above critical), intermediate pressure (subcritical), and modular (transfer of tanks). The initial screening task was completed for the intermediate pressure or subcritical systems. In performing the comparison analyses the subcritical systems were categorized as follows: surface force systems, capillary system, dielectrophoretic system, positive expulsion systems, bladders, metallic bellows, diaphragms, dynamic force systems, and evaporation system. In the case of the high pressure systems, essentially all comparisons are integrally dependent on thermodynamic and fluid properties associated with the receiver transfer line, and supply. This is unlike the subcritical systems where the fluid state is essentially fixed for different supply concepts. E.M.C.

N71-14114*# Battelle Memorial Inst., Columbus, Ohio.

ELECTROSTATIC HAZARDS DURING LAUNCH VEHICLE FLIGHT OPERATIONS

P. G. Andrus and L. E. Walkup 12 Feb. 1969 31 p refs

(Contract NASw-1146)

(NASA-CR-111727; BMI-NLVP-TM-69-1) Avail: NTIS CSCL 22D

Various mechanisms causing buildup of electrostatic charges on launch vehicles during normal flight operations, various discharge phenomena, some examples of past failures which were (or may have been) due to electrostatic effects, means for reducing the probability of such failures, and the need for and possible means for obtaining additional pertinent data are discussed. Substantial electrostatic charges can build up on launch vehicles during normal flight operations due principally to induction effects, engine-exhaust charging, and triboelectrification. These charges can produce spark, streamer, or corona discharges. Spark and streamer discharges can trigger certain electroexplosive devices, and all three types of discharges can produce anomalies in sensitive digital circuitry and noise in communication channels. Electrostatic effects have been blamed for two minuteman failures and two Titan guidance anomalies. In addition, they may have been involved in two Scout failures. Careful bonding of all conductors probably would have prevented these difficulties. Similar measures studiously applied can probably prevent future difficulties from electrostatic discharges. Author

N71-14115*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N.Y.

STUDY OF HOUSEKEEPING CONCEPTS FOR MANNED SPACE SYSTEMS Final Report

30 Oct. 1970 139 p refs

(Contract NAS9-10662)

(NASA-CR-108763; MS124Y0003; MSC-01250) Avail: NTIS CSCL 22B

A data book was generated on the waste control aspect of housekeeping for future manned orbital missions. The data is intended for use by the mission planner, to permit overall assessment of the waste control problem, crew assignments and logistics planning; the spacecraft conceptual designer, for selection of equipment for handling, processing and disposal; and the equipment designer, by providing conceptual designs of procedures and equipment. The information is in parametric from applicable to crew sizes up to 100 men, a spacecraft life of up to 10 years, and a wide range of mission tasks and experiments. The subjects covered are: (1) identification of waste products, their source, rates of generation and interfacing information for handling and processing; (2) utilization processes to reclaim or convert waste products to consumables/expendables in lieu of logistical resupply; (3) pretreatment processes for disposal for deactivation of sterilization of organic or potentially pathogenic wastes and the compaction and packaging of deactivates wastes. (4) waste disposal concepts for separating waste products from the spacecraft; (5) waste control and housekeeping data for crew procedures and assignment planning, manual and automated equipment for waste collection, pickup, transfer and sorting, and information on crew interfacing with processing and disposal equipment; and (6) search report computer program for the storage of the large volume of data included in the data book and permitting the performance of automated searches. The data and potential usage of the data are summarized, and recommendations for future work in the problem areas of waste control are presented. Author

N71-14116# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A PASSIVE STABLE SATELLITE FOR EARTH-PHYSICS APPLICATIONS. CANNONBALL: A SATELLITE FOR ACCURATE LASER RANGING

G. C. Weiffenbach and T. E. Hoffman 30 Nov. 1970 58 p refs

(SAO-SR-329; SAO-010-38A) Avail: Issuing Activity

A compact solid uranium sphere equipped with a laser retroreflector array is considered as a satellite for the Earth-Physics Program to provide an orbiting bench mark of maximum accuracy. Global measurements of ground-station positions with accuracies within 10 cm are considered possible. The characteristics of the satellite for optimum geometric measurements, the scientific objectives, orbit requirements, and satellite design are discussed. F.O.S.

N71-14142*# Martin Marietta Corp., Denver, Colo.

WEIGHT ESTIMATING AND FORECASTING DURING CONCEPTUAL DESIGN Final Briefing Material

Nov. 1970 62 p

(Contract NAS9-10326)

(NASA-CR-108749; MSC-01258) Avail: NTIS CSCL 22B

Two methods for estimating the weight of manned spacecraft and space station configurations during conceptual design are given. The purpose of the estimation is to provide a means of forecasting the vehicle weight to be expected upon delivery. Results are given in tabular and graphical form. Author

N71-14143*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

APOLLO/SATURN 5 CONSOLIDATED INSTRUMENTATION PLAN FOR AS-501 (APOLLO 14)

D. E. Clark 7 Dec. 1970 75 p

(NASA-TM-X-66507; KSC-K-V-059/9) Avail: NTIS CSCL 22B

The consolidated instrumentation plan for employing optical and electronic data acquisition systems to monitor the performance and trajectory of Apollo Saturn 5 vehicle 509 during the launch phase of the mission (prelaunch, liftoff to insertion) is presented.

Telemetry, optical, and electronic tracking equipment on board the vehicle and data acquisition systems monitoring the flight are discussed. Flight Safety instrumentation, vehicle data transmission systems, and geophysical instrumentation are also described. Author

N71-14185*# Martin Marietta Corp., Denver, Colo.
WEIGHT ESTIMATING AND FORECASTING OF MANNED SPACE SYSTEMS DURING CONCEPTUAL DESIGN
Summary Report
Nov. 1970 18 p
(Contract NAS9-10326)
(NASA-CR-108765; MSC-01261) Avail: NTIS CSCL 22B

A rational approach, based on design statistics, is provided for estimating and forecasting weight of manned space systems during conceptual design. The handbook contains two rapid empirical methods of estimating the design weight and gives a detailed series of design relationships to estimate vehicle subsystem weights. It is to be noted, however, that the process utilized in developing the subsystem weight estimation equations automatically includes adjustments in weight to accomodate inherent design weight growth. Meaningful weight growth data pertaining to past programs are also presented which serve as an added tool in deriving realistic flight weight estimates. In addition to the handbook methods, an integrated computer program was developed to provide rapid response in the derivation of vehicle weight estimates and size determinations. E.M.C.

N71-14270*# Aerojet-General Corp., El Monte, Calif. Medical and Biological Systems.
DEVELOPMENT OF BACTERIAL SENSING INSTRUMENTATION FOR SPACECRAFT WATER SYSTEMS
Final Report
13 Nov. 1970 99 p refs
(Contract NAS9-10432)
(NASA-CR-114779; Rept-1504-F) Avail: NTIS CSCL 22B

The porphyrin initiated chemiluminescence technique forms the basis of an instrument which was developed for monitoring water sterility in spacecraft water storage and supply systems. The instrumentation permits differentiation between living and dead organisms by comparing the chemiluminescent signals of incubated and unincubated water samples: a higher signal for the incubated sample is used to indicate nonsterility of the water supply. The system selected for the breadboard prototype is both sensitive and rapid and has the potential of being developed into a compact lightweight instrument capable of operation in a zero gravity environment. Author

N71-14297# Institut d'Aeronomie Spatiale de Belgique, Brussels.
A SHORT SURVEY OF MANNED SPACE FLIGHT [BONDIG OVERZICHT DER BEMANDE RUIMTEVAART]
E. Aerts 1970 85 p In DUTCH; ENGLISH summary *Its* Aeronomica Acta No. F-17-1970
Avail: NTIS

This review for high school students surveys all American and Russian manned space flight projects carried out before mid-1970. ESRO

N71-14298# Danish Meteorological Inst., Charlottenlund.
DIURNAL VARIATION OF AURORAL FREQUENCY OVER GREENLAND 1963 – 1966 (IQSY)
K. Lassen 1970 38 p refs Sponsored in part by Danish State Res. Found. *Its* Geophys. Papers No. R-14
Avail: NTIS

Data from six IQSY all-sky camera stations in Greenland are discussed. Mean daily distributions of auroral frequency are presented for selected parts of the sky at each site and the zenithal frequencies are given for each of the three winters. The auroral distribution was very similar to that of electron concentration enhancements at 1000 km measured by Alouette 1 during the same period, so both phenomena could be due to the precipitation of 1 keV electrons in a similar pattern. It is likely that the auroral distributions is formed by the overlapping of two separate auroral distributions having night-time and daytime occurrence frequency maxima. Author (ESRO)

N71-14366*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1969 SCAN CONTROL SUBSYSTEM DESIGN AND ANALYSIS
T. Kerner and H. H. Horiuchi 30 Oct. 1970 29 p
(Contract NAS7-100)
(NASA-CR-111703; JPL-TR-32-1506) Avail: NTIS CSCL 22B

The SCAN platform control system designed for the Mariner Mars 1969 spacecraft is described. The platform, which acts as a mounting base for the science instruments, has two deg of freedom about a set of spacecraft fixed coordinates. The system controls the platform movement and position. This report covers the detailed system design, the servo analysis, and the system error analysis. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-13557# Illinois Univ., Urbana. Dept. of Civil Engineering.
THREE-DIMENSIONAL PHOTOELASTIC INVESTIGATION OF SIMULATED WELD DISCONTINUITIES
Henning Ottsen and W. H. Munse Mar. 1970 139 p refs Sponsored in part by State of Ill., Div. of Highways and by Bur. of Public Roads *Its* Structural Res. Ser. No. 358
(PB-194057) Avail: NTIS CSCL 13E

The effect of an internal flaw in a welded connection on the fatigue behavior of that connection was studied. A method was sought which, on the basis of material properties, type of defect, and loading, could be used to predict the fatigue behavior of the member. Author (USGRDR)

N71-13610 University of Southern Calif., Los Angeles.
THE FLUTTER OF A TRIANGULAR PANEL
Edward Arthur Wais (Ph.D. Thesis) 1969 233 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.05 Order No. 70-371

The use and application of the finite element method to general problems in continuum mechanics and particularly to the investigation of the flutter of thin panels is discussed. Panel flutter refers to the unstable oscillations of thin plates, shells, or membranes in a fluid flow caused by the aerodynamic loading. The finite element method, a variation of the Ritz method in the calculus of variations, is used to generate stiffness and mass matrices which respectively represent the elastic and inertia characteristics of the continuum. A slight variation of the finite element method is used to generate an aero matrix which represents the aerodynamic loading in the panel flutter problem. The use of the finite element method allows continua problems to be reformulated as problems of assemblages of discrete elements which are then solved by the use of matrix methods. Dissert. Abstr.

N71-13743# General Electric Co., Schenectady, N.Y. Mechanical Engineering Lab.

STRUCTURAL ANALYSIS BY INTEGRAL TECHNIQUE: THREE DIMENSIONAL PROBLEMS WITH OR WITHOUT THERMAL GRADIENT EFFECTS

H. L. Lui and A. J. Martenson Apr. 1970 32 p refs
(Rept-70-C-148) Avail: NTIS

The usefulness of the integral formulation method of stress analysis was demonstrated previously by developing the fundamental equations and procedures for solving plane elasticity problems with prescribed tractions. This method is extended to three dimensions with or without steady-state thermal stresses. It is assumed that the elastic body is isotropic and homogeneous. However, the technique can be extended to solve problems which involve inhomogeneous media and anisotropic bodies. It can also be applied to problems in viscoelasticity and the propagation of elastic waves in solids. Author

N71-13818# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

EDDY CURRENT MULTIPARAMETER TEST FOR TUBE FLAWS IN SUPPORT REGIONS

H. L. Libby and C. R. Wandling Aug. 1970 25 p ref
(Contract AT(45-1)-1830)
(BNWL-1468) Avail: NTIS

Results of laboratory investigations showed that two-frequency multiparameter eddy current nondestructive testing offers a way to dramatically reduce interfering tube test signals caused by simulated tube supports made of stainless steel or mild steel. An analysis of complex plane data of the tube support signals and a signal caused by a suspected region of intergranular corrosion in a stainless steel tube confirms the discrimination which was observed experimentally. The test described appears to be a workable system which represents a compromise between full application of the multiparameter test principles with the resulting complexity of circuits and adjustments and a test system of reasonable complexity which may meet the needs of practical field problems. Further tests are needed using real tube supports to determine optimum operating conditions. Author (NSA)

N71-13819# California Univ., Berkeley. Earthquake Engineering Research Center.

DYNAMIC STRESS ANALYSIS OF AXISYMMETRIC STRUCTURES UNDER ARBITRARY LOADING

Sukumar Ghosh and Edward Wilson Sep. 1969 207 p refs
(Contract NSF GK-4395)
(PB-189026; EERC-69-10) Avail: NTIS CSCL 08J

A finite element method is presented for the dynamic analysis of complex axisymmetric structures subjected to any arbitrary static or dynamic loading or base acceleration. The three dimensional axisymmetric continuum is represented either as an axisymmetric thin shell, a solid of revolution, or as a combination of both. Hamilton's variational principle is used to derive the equations of motion for this discrete structure. This leads to a mass matrix, stiffness matrix, and load vectors which are all consistent with the assumed displacement field. To minimize computer storage and execution time a diagonal mass matrix has been assumed in writing the computer program. For an earthquake analysis, the response spectrum technique may be used to obtain approximate values of the maximum response quantities if detailed time history of the response is not desired. This method of analysis is applied to various practical cases. Author (USGRDR)

N71-13862*# Digitek Corp., Marina del Rey, Calif.

INVESTIGATION OF STATISTICAL TECHNIQUES TO SELECT OPTIMAL TEST LEVELS FOR SPACECRAFT VIBRATION TESTS Final Report, 1 Nov. 1969 - 31 Oct. 1970

Alan G. Piersol and John R. Maurer Oct. 1970 85 p refs
(Contract NAS5-21093)
(NASA-CR-115778; Rept-10909801-F) Avail: NTIS CSCL 20K

Analytical expressions defining optimal test levels for various types of vibration testing of spacecraft hardware are derived using a minimum cost of error criterion. The developments assume the service environmental loads and hardware strengths are random variables with either lognormal or normal probability density functions. The resulting expressions for optimal test levels are functions only of the distribution of environmental loads and cost factors defining the undesirable consequences of potential test and service failures. The results indicate the principal factors which should influence vibration test levels are the purpose of the test, the cost of developing the hardware, and the cost of a potential service failure. Specifically, all other things equal, qualification (design verification) tests should be more severe than acceptance (manufacturing quality verification) tests; tests of relatively expensive hardware should be less severe than tests of less expensive hardware; and tests of hardware whose failure in service might produce relatively serious consequences should be more severe than tests of hardware whose failure in service would produce less serious consequences. Author

N71-13864# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Civil Engineering.

INSTABILITY OF HORIZONTALLY CURVED MEMBERS. FLANGE BUCKLING STUDIES

Charles Culver and Ghulam Nesir Nov. 1969 107 p refs
Sponsored by Pa. Dept. of Public Highways and Dept. of Transportation
(PB-192901) Avail: NTIS CSCL 13M

An analytical study of the buckling behavior of the flanges of horizontally curved plate girders is presented. Buckling in both the elastic and inelastic range is considered. The influence of residual stresses resulting from the fabrication process are included. The mathematical model is developed using orthotropic plate theory and solved by means of first order finite differences. The influence of the various parameters which affect the buckling stress is illustrated. Design recommendations for the flange dimensions (width to thickness ratio) required to prevent local buckling are also given. Author (USGRDR)

N71-13944# Newark Coll. of Engineering, N.J. Dept. of Mechanical Engineering.

DIGITAL COMPUTER PROGRAM FOR STRESSES IN ECCENTRIC STEPWISE DISCONTINUOUS RINGS WITH TRANSITION SECTION

Arnold Allentuch and Eugene Golub Aug. 1970 47 p refs
(Contract N00014-67-A-0225-0001)
(AD-712518; NCE-NV-1) Avail: NTIS CSCL 20/11

A computer program is presented which gives the stress distribution in a ring of nonuniform cross section under the action of a uniform radial line load. The analysis on which the program is based is an approximation to the analysis of an exact interaction problem of a reinforced circular cylindrical shell under hydrostatic pressure. The ring is composed of three segments; one segment whose cross sectional area varies according to a power function connects two uniform segments. The computer program is written for a General Electric 605 Time Sharing computer. A complete listing of the program including full documentation is presented. In addition, a typical computer run is included. Author (TAB)

N71-13945# Oak Ridge National Lab., Tenn.

NEW TECHNIQUE FOR ULTRASONIC FLAW DETERMINATION BY SPECTRAL ANALYSIS

H. L. Whaley and Laszlo Adler Sep. 1970 40 p ref
(Contract W-7405-eng-26)
(ORNL-TM-3056) Avail: NTIS

A new method for the characterization (determination of the size and orientation) of a reflector by ultrasonic spectral analysis was developed. This technique can be used to determine nondestructively the nature of flaws detected in a material by means of ultrasonic examination. It is feasible to characterize a flaw by this technique in spite of its composition (i.e., crack, void, or inclusion) or shape without the need for a calibration standard. This technique is free of several limitations inherent in techniques based on amplitude. The results presented are based on a series of reflection experiments in which the ends of solid rods immersed in water and machined discontinuities in metal samples were used as reflectors. Broadbanded ultrasonic pulses were analyzed after reflection from the interface of interest. A physical and analytical model was developed based on an interference mechanism that results from the superposition of spherical wavelets emitted from opposing extremes of the reflector. Author

N71-13948# Notre Dame Univ., Ind. Coll. of Engineering.
INELASTIC BUCKLING OF AXISYMMETRIC SHELLS
James C. Hayes and Lawrence H. N. Lee Aug. 1970 64 p refs
(Contract N00014-68-A-0152)
(AD-712522; THEMIS-UND-70-10) Avail: NTIS CSCL 20/11

An incremental variational method is presented for the determination of the inelastic load-deformation relationship, as well as the buckling or collapse load for a shell of revolution which is made of a work hardening material and subjected to axisymmetric loadings. A variational principle involving the Kirchhoff stress tensor, the Green strain tensor, and their rates is employed. The isothermal stress-strain relationship based on a modified J2 incremental theory of plasticity is used. A seven sheet sandwich shell idealization and the finite difference method of variational calculus are utilized in a numerical procedure in order to determine discrete velocities and a subsequent deformation process. The buckling loads of a number of elastic and inelastic cylindrical and truncated conical shells as well as inelastic spherical shell caps are determined. The results of the present analysis, obtained numerically by a Univac 1107 digital computer, compare favorably with available experimental data. Author (TAB)

N71-14006# Battelle Memorial Inst., Columbus, Ohio.
STRESS INDICES FOR SMALL BRANCH CONNECTIONS WITH EXTERNAL LOADINGS Phase Report No. 118-1
E. C. Rodabaugh Aug. 1970 88 p refs Prepared for Oak Ridge Natl. Lab.
(Contract W-7405-eng-26)
(ORNL-TM-3014) Avail: NTIS

Stress indices and simplified design formulas were developed for use in the stress analysis of small branch connections in Class 1 piping systems. Equations are given for reducing the set of nine moments which act on a branch connection, and whose numerical values are obtained from a piping flexibility analysis to two resultant moments. Stress indices to be used with these resultant moments are empirically developed from existing test data and design rules are proposed. The effects of direct shear force loadings on branch connections are also discussed. Author (NSA)

N71-14009# Newark Coll. of Engineering, N.J. Dept. of Mechanical Engineering.
DIGITAL COMPUTER PROGRAM FOR ASYMPTOTIC SOLUTION FOR SHORT RING-REINFORCED OVAL CYLINDERS
Eugene Golub and Arnold Allentuch Aug. 1970 85 p refs
(Contract N00014-67-A-02225-0001)
(AD-712519; NCE-NV-2) Avail: NTIS CSCL 20/11

A computer program is presented which gives the displacements and the stress distribution in a hydrostatically loaded ring-reinforced noncircular cylinder. The solution on which the program is based is obtained by an asymptotic expansion procedure in which a typical bay of the stiffened cylinder is considered. The existence of two distinct characteristic lengths is used in the construction of two asymptotic series which, when combined, form the total solution. The solution to this problem was obtained by N. B. Nissel and W. P. Vetakos at the Polytechnic Institute of Brooklyn (see Ref. (1)). The computer program is written for a General Electric 605 Time Sharing Computer. A complete listing of the program including full documentation is presented. In addition, a typical computer run is included. Author (TAB)

N71-14056*# National Aeronautics and Space Administration. Langley Research Center, Langely Station, Va.
THEORETICAL AND EXPERIMENTAL VIBRATION AND BUCKLING RESULTS FOR BLUNT TRUNCATED CONICAL SHELLS WITH RING-SUPPORTED EDGES
Sidney C. Dixon, Robert Miserentino, and M. Latrelle Hudson Washington Dec. 1970 33 p refs
(NASA-TN-D-7003; L-7061) Avail: NTIS CSCL 13M

Theoretical results indicate that rings designed to provide edge restraint between simple and clamped support on the basis of buckling calculations do not provide the equivalent support on the basis of vibration calculations for modes having few circumferential waves. The natural frequencies for these modes were considerably below the minimum frequencies for shells with simply supported or clamped edges. For such cases, studies indicate that substantial increases in ring size and mass are required to effect a significant increase in the minimum frequency of ring-supported shells. Experimental buckling and vibration results were obtained for four blunt truncated conical shells essentially clamped at the small end and ring supported at the large end. Buckling was induced by aerodynamic loading in wind tunnel tests. Theoretical results for the same shells are in good qualitative agreement with the experimental results, but the quantitative agreement is only fair. Author

N71-14080*# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
FRACTURE MECHANICS AND THE TIME DEPENDENT STRENGTH OF ADHESIVE JOINTS
W. G. Knauss Sep. 1970 35 p refs
(Grant NGL-05-002-005)
(NASA-CR-111761; GALCIT-SM-70-6; GALCIT-120) Avail: NTIS CSCL 13E

The problem of time dependent failures of elastic or viscoelastic solids jointed by a polymeric bonding layer is dealt with. The problem is analyzed in relation to microscopic processes and macroscopic stress fields acting on the joint system. The material presented covers the following topics: (1) stress analysis of imperfect bonds; (2) equations governing time dependent joint fracture; (3) descriptions of time dependent effect and transition from adhesive to cohesive fracture; and (4) influence of the fracture path on joint strength. D.L.G.

N71-14088*# Aeronautical Research Associates of Princeton, Inc., N.J.
A STUDY OF PANEL FLUTTER WITH THE EXACT METHOD OF ZEYDEL
J. E. Yates Washington NASA Dec. 1970 98 p refs
(Contract NAS8-24390)
(NASA-CR-1721; ARAP-145) Avail: NTIS CSCL 13M

The exact method of Zeydel for calculating flutter boundaries and estimating stresses in an infinite spanwise array of panels is presented. The theory is based on the exact linearized inviscid aerodynamic theory. A general analysis of orthotropic panels is presented that accounts for different edge conditions, elastic

foundation, membrane stresses, and viscous and structural damping. Various asymptotic results are presented for very long panels. Two limits of the exact theory are discussed that correspond to the simple static aerodynamic theory approximation and the traveling-wave theory, respectively. A further result for the mode shape of a semi-infinite panel is presented that shows how a traveling wave is amplified and reflected by the trailing edge. Extensive numerical calculations are presented for the special case of pinned edge panels, isotropic panel material, zero viscous damping, and no elastic foundation. Comparisons are made with previous results that verify the computational procedure. Design flutter boundaries of mass ratio versus length-to-width ratio for different materials and altitude are presented. Typical mode shapes are also given. The effect of structural damping at different Mach numbers and length-to-width ratios is discussed. Example calculations of the stress level in a panel are made. Design flutter boundaries are presented for aluminum panels on a typical Saturn 5 trajectory. Flutter is indicated for certain panels on the forward skirt of the S-4B stage, in agreement with in-flight data. Because of the relatively short duration of flutter, it is concluded that failure is not likely to occur. Author

N71-14099# Idaho Nuclear Corp., Idaho Falls.
INCIPIENT FAILURE DETECTION BY ACOUSTIC EMISSION: A DEVELOPMENT AND STATUS REPORT
D. L. Parry and D. L. Robinson Jul. 1970 111 p refs
(Contract AT(10-1)-1230)
(IN-1398) Avail: NTIS

A practical incipient failure detection system, based on the phenomenon of acoustic emissions from imperfections in structural materials under stress, has been developed and tested on pressure vessels of various sizes and degrees of complexity. The acoustic emission technique has proven capable of rapidly detecting and locating flaws during hydrostatic acceptance and requalification testing of nuclear reactor pressure vessels. The technique, coupled with other standard nondestructive testing techniques, can provide improved capability for the integrity analysis of a wide variety of complex industrial structures. Author (NSA)

N71-14144# Joint Publications Research Service, Washington, D.C.
VIBRATION STABILITY
I. Ananyev et al 10 Dec. 1970 3 p Transl. into ENGLISH from Aviats. i Kosmonaut. (Moscow), no. 11, 1970 p 20-23
(JPRS-51966) Avail: NTIS

Vibrational loads of basic airplane (helicopter) structures in various modes of operation are carefully analyzed for the purposes of protecting the structures from vibrations and ensuring flight safety. Also, the frequency of variable loads are determined, the possible causes of vibrations are established, and measures are taken to eliminate vibrations and to reduce the levels of resulting variable stresses in the structure. In so doing, even low level vibrations are taken into account, since after sufficiently prolonged operation fatigue failure may occur in the structure. Author

N71-14145# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE INITIATION AND EXTENT OF DUCTILE PIPE RUPTURE, PHASE 2 Progress Report, Apr.-Jun. 1970
Robert J. Eiber, Willard A. Maxey, Arthur R. Duffy, and Thomas J. Atterbury Jul. 1970 4 p
(Contract W-7405-eng-92)
(BMI-1887) Avail: NTIS

Activities directed toward determining whether propagating fractures in pipe under subcooled conditions will be arrested when the pressure decay is retarded, are reported. Configuration for proposed experiment 28 is discussed and illustrated. NSA

N71-14163# Texas Univ., Austin. Engineering Mechanics Research Lab.
THE EFFECT OF AIRDROP IMPACT ON COMPLEX STRUCTURES Final Report, Aug. 1967-Dec. 1969
Song Fong Jan and E. A. Ripperger Dec. 1969 50 p refs
(Contract DAAG17-67-C-0189)
(AD-711555; TR-70-55-AD) Avail: NTIS CSCL 15/7

The accelerations and displacements in a complex structure subjected to an impact loading are computed by treating the structure as a lumped parameter system. A mathematical model of the system consists basically of discrete masses linked by weightless, elastic beams with the appropriate stiffnesses, areas, and moment of inertia properties. By specifying a proper set of independent coordinates through which the motion of these lumped masses are uniquely described, and by writing equations of motion in terms of these coordinates, a set of equations is derived which represents the motion of any part of the model during impact. Using the Runge-Kutta numerical method, and a digital computer, these equations are solved. A physical model of the lumped parameter system was built and cushioned with paper honeycomb. Displacements and accelerations at some points in this model were measured and compared with computed results. Agreement is satisfactory. Author (TAB)

N71-14178# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Ocean Engineering.
PREDICTION OF MOTIONS OF OCEAN PLATFORMS IN OBLIQUE SEAS
C. H. Kim and F. Chou Jun. 1970 82 p refs
(Grant NSF GH-60)
(PB-193873; SIT-OE-70-1) Avail: NTIS CSCL 13J

Frank's method of calculating hydrodynamic forces and moments on oscillating cylinders is extended not only to the calculation of hydrodynamic moment arms but also to the calculation of wave-exciting forces and movements on a restrained ocean platform in oblique waves. The coupled vertical and lateral equations of motion are applied in determining the important motions of ocean-platform models of the ship and jackup type, in oblique seas. The predictions are in good agreement with the experimental results. Author (USGRDR)

N71-14200# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
NONLINEAR VIBRATION OF BUCKLED BEAMS AND PLATES
Gwo-Bao Min and Joe G. Eisley Apr. 1970 122 p refs
(Grant NSF GK-10725)
(PB-193885; Rept-03021) Avail: NTIS CSCL 13M

The purpose is to examine the theoretical response and stability of free and forced vibration of a simply supported, buckled, beam and rectangular plate. The equations of motion dealing with the buckled position in multiple degrees of freedom include the effect of an initial displacement caused either by initial axial load or by initial temperature. By assumed mode solution, two types of vibration are investigated: snap-through vibration (symmetrical vibration) and one-side vibration (unsymmetrical vibration). A small perturbation yields the Hill or Mathieu type of differential equation for stability investigation. Since the equations are coupled through the nonlinear term the excitation of one particular mode may feed some of its energy into other modes and cause the rest modes to vibrate. Thus this study examines not only the response and stability of the excited mode but also the response and stability of the rest modes. Author (USGRDR)

N71-14286# California Univ., Berkley. Structural Engineering Lab.
EVALUATION OF DISCRETE METHODS FOR THE LINEAR

DYNAMIC RESPONSE OF ELASTIC AND VISCOELASTIC SOLIDS

G. L. Goudreau (Ph.D. Thesis) Jun. 1970 131 p refs
(PB-194286; SESM-69-15) Avail: NTIS CSCL 20K

Governing field equations are given for the linear mechanical theory of solids, including the extension of Hamilton's principle to viscoelastic solids. Through the use of convolutions, a principle is constructed whose Euler equations are the integral equations of motion, containing the initial conditions. Closed form solutions are presented for the lumped and consistent mass finite element models of the simple bar, membrane, and beam operators. Further, the spectral approximation to the two radial mode Mindlin-Hermann bar theory is studied. Step-by-step schemes for the time integration of discrete systems are discussed. A property of the explicit time integration scheme which gives it the power to capture discontinuities in the propagation of stress waves is also discussed. The method embodies the 'direct' or 'discontinuous step' method of Mehta and Davids and Koenig in conjunction with a finite element spatial discretization. USGRDR

N71-14318# Grumman Aerospace Corp., Bethpage, N.Y. Geo-Astrophysics Section.

APPLICATION OF THE THEORY OF PLASTICITY TO THE ANALYSIS OF STRESS DISTRIBUTION BENEATH WHEELS

Leslie L. Karafiath Dec. 1970 29 p refs Presented at the TRW Intern. Soc. for Terrain-Vehicle Systems Off-Road Mobility Symp., Los Angeles, 3-4 Nov. 1970
(RE-399J) Avail: NTIS

The prediction of wheel-performance of off-the-road vehicles requires the determination of the distribution of stresses at the soil-wheel interface. Experiments show that a forward and a backward failure zone develops beneath towed or driven rigid wheels. The geometry of these failure zones as well as the associated stresses are governed by the differential equations of plasticity. A computer program was developed for the numerical solution of these differential equations with respect to the boundary conditions at the soil-wheel interface. The interface stresses determined by this method are in good agreement with experimental measurements. The method is particularly useful for the solution of lunar locomotion problems since it allows the consideration of lunar gravity as well as the effect of slopes. Author

N71-14319# National Aeronautical Establishment, Ottawa (Ontario).

FINITE ELEMENT DYNAMIC ANALYSIS OF SHALLOW SHELL STRUCTURES

G. M. Linderberg, M. D. Olson, and A. C. Serazin Jul. 1970 70 p refs
(NRC-11653; LR-540) Avail: NTIS

An efficient dynamic analysis capability for arbitrary shallow shell structures is developed and illustrated with several applications with experimental verifications. The method is based on a compatible, doubly-curved shallow shell element of arbitrary triangular shape which includes thickness variations. This element uses as generalized displacements at each vertex the normal displacement w and its first and second derivatives plus the tangential displacements u and v and their first derivatives. Once the master matrices for a shell are assembled, the tangential inertias are neglected, and all tangential degrees of freedom are condensed out thus greatly reducing the eigenvalue problem sizes. Numerical results from the applications show that natural frequencies and mode shapes are always predicted with good accuracy even with coarse gridworks, and convergence with element gridwork refinement is always monotonic and exceedingly rapid. Author

N71-14347 Delaware Univ., Newark.

A RANDOM WALK APPROACH TO FIRST-PASSAGE AND OTHER RANDOM VIBRATION PROBLEMS

Richard Harvey Toland (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-21955

In the study of randomly excited structural and mechanical dynamic systems, problems of great current interest include: 1. the response of systems with various forms of nonlinearity; 2. the reliability of both linear and nonlinear systems. One fruitful approach is the Markov vector method where for a particular type of random excitation process, specifically a Gaussian shot noise, the response process of such systems is known to be Markovian. Markov processes form a well-studied class of stochastic processes. A differential equation with appropriate boundary and initial conditions and usually referred to as the Fokker-Planck equation governs the probability density function of the system response and the solution provides the desired complete probabilistic description. Unfortunately, the complete time dependent solution of the Fokker-Planck equation corresponding to nonlinear systems is not known. Dissert. Abstr.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-13597# Du Pont de Nemours (E. I.) and Co., Richmond, Va. Sprusance Film Research and Development Lab.

SOME THERMODYNAMIC ASPECTS OF POLYMER ADHESION

D. K. Owens [1969] 15 p refs
Avail: NTIS

The surface free energy of polymers and the separation of this free energy into dispersion and hydrogen-bonding components were estimated. The thermodynamic reversible work of adhesion of a vinylidene chloride copolymer coating to polypropylene film was calculated. Adhesion effects on immersion of the coated polypropylene in water and surfactant solutions were calculated. When the calculated work of adhesion was negative, spontaneous separation of the coating from the polypropylene occurred upon immersion in all cases. When the calculated work of adhesion was positive, no separation was observed in agreement with theory. Author

N71-13688*# Geoscience, Ltd., Solana Beach, Calif.

SNAP-8 BOILER PERFORMANCE DEGRADATION AND TWO-PHASE FLOW HEAT AND MOMENTUM TRANSFER MODELS

H. F. Poppendiek Aug. 1970 69 p refs
(Contract NAS3-11838)
(NASA-CR-72759; GLR-84) Avail: NTIS CSCL 18N

Boiler deconditioning phenomena and possible causes are reviewed. Controlling heat transfer mechanisms in connection with deconditioning are described, and the results of analyses that define 4P3E oil transport, decomposition, and deposition in boiler tubes are summarized. Heat transfer and fluid flow models that describe a number of pertinent flow regimes and phase distributions are recapitulated. Limitations and applicability criteria are also presented for the models. In addition, a number of practical questions relating to boiler design and performance are considered. Author

N71-13622# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.
INVESTIGATING POSSIBILITIES OF WIRE-EXPLOSION-LIKE EXPERIMENTS WITH LIQUID NITROGEN JETS AND SOLID NITROGEN WIRES [UNTERSUCHUNG DER MOEGLICHKEITEN FUER DRAHTEXPLOSIONSAEHNLICHE EXPERIMENTE MIT STRAHLEN AUS FLUESSIGEM STICKSTOFF UND DRAEHTEN AUS FESTEM STICKSTOFF]
Ulrich Wittkowski (Ph.D. Thesis) 1970 94 p refs In GERMAN
Avail: NTIS

The production of liquefied nitrogen jets and wires made from solidified nitrogen for explosive wire experiments is reported. Thin nitrogen jets of about 10 cm lengths were formed when the pressure around the jet was higher than the vapor pressure in the liquid jet; channel-shaped discharges formed in gaseous nitrogen at pressures above the triple pressure point. Experiments with 15 cm long wires made from solid nitrogen found that environmental pressure of about 1 Torr initiated gas discharge in the shape of a hollow plasma cylinder on the wall of the discharge tunnel; Schlieren photography established wire heating and nitrogen evaporation during plasma contraction. Heat transfer to the nitrogen wire during 10 microseconds heated the outer wire layer up to nitrogen boiling temperature. Transl. by G.G.

N71-13750# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
THERMAL CONDUCTIVITY INSTALLATION FOR IRRADIATED SOLIDS [INSTALLATION DE CONDUCTIMETRIE THERMIQUE POUR SOLIDES IRRADIES]
Bernard Mansard and Michel Lauger-Hache Jun. 1970 27 p refs In FRENCH
(CEA-N-1303) Avail: AEC Depository Libraries

Processes and apparatus used in hot cells for measuring the thermal conductivity of various irradiated materials up to 1000 C are described. Author (NSA)

N71-13873# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETERMINATION OF THE THERMAL CONDUCTIVITY OF DIFFERENT MATERIALS UP TO 1000 C. APPLICATION TO GRAPHITES AND CARBONS, BORON CARBIDE, AND SOME COMPOUNDS BASED ON BORON CARBIDE [DETERMINATION DE LA CONDUCTIBILITE THERMIQUE DE DIFFERENTS MATERIAUX JUSQU'A 1000 C. APPLICATION AUX GRAPHITES ET CARBONES, AU CARBURE DE BORE ET A QUELQUES COMPOSES A BASE DE CARBURE DE BORE]
P. Degas and J. L. Bertin [1970] 26 p In FRENCH Presented at the 2d European Conf. on Thermophys. Properties of Solids at High Temp., Risley, England
(CEA-Conf-1563; Conf-700422-1) Avail: AEC Depository Libraries

An apparatus was developed to measure the thermal diffusivity of solids by the flash method between room temperature and 1000 C. The thermal conductivity is deduced from these measurements by using the published specific heat values. The energy applied on the front face of the sample is provided either by a lamp which delivers an energy 2000 joules per flash, or by a ruby laser of output energy at each impulse adjustable from 1 to 10 joules. The sample, generally in the form of a pellet of diameter around 10 mm, is placed in an insulating stumatite holder. The temperature increase of a few degrees centigrade on the rear face of the sample is detected by means of a thermocouple, the electromotive force variation of which is transmitted to an oscilloscope after amplification. The sample-holder unit is placed in a furnace supplied by direct current to avoid perturbations on the thermocouple signal. The measurements may be carried out under vacuum or under a pressure. Author (NSA)

N71-14030# Sandia Corp., Albuquerque, N.Mex.
EXPLODING WIRES AS SHOCK-WAVE SOURCES
G. A. Carlson Jul. 1970 24 p refs
(SC-RR-70-65) Avail: NTIS

An exploding wire system is reported which produces shock waves at about 50 percent efficiency over two orders of magnitude in stored electrical energy (0.11 to 1.25 joules). The efficiency of exploding wires is related to the physical and electrical processes occurring during wire explosions. Author (NSA)

N71-14031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTION OF FRICTION AND HEAT-TRANSFER COEFFICIENTS WITH LARGE VARIATIONS IN FLUID PROPERTIES
Maynard F. Taylor Washington Dec. 1970 13 p refs
(NASA-TM-X-2145; E-5221) Avail: NTIS CSCL 20M

The conventional methods of predicting single phase turbulent heat transfer and friction coefficients often give values that are in poor agreement with measured values when large variations in the fluid properties are present. Heat transfer and friction data for hydrogen, helium, nitrogen, air, and carbon dioxide were used to determine the best available relation for correlating friction and heat transfer coefficients for heat addition to, and heat extraction from, gases flowing subsonically through a smooth tube. Author

N71-14032* TRW Systems Group, Redondo Beach, Calif.
ABLATIVE RESIN Patent
Hyman R. Lubowitz, Eugene A. Burns, and William P. Kendrick, inventors (to NASA) Issued 20 Jan. 1970 (Filed 23 May 1966) 3 p Cl. 117-106; Int. Cl. C23c11/02 Sponsored by NASA
(NASA-Case-XLE-05913; US-Patent-3,490,939; US-Patent-Appl-SN-551933) Avail: US Patent Office CSCL 11C

A method for retarding the rate of regression of an ablative surface exposed to high temperature gas is given. Ablative resins are fabricated using the polyalkaline earth metal acrylate in the process. Results show the metal decomposes to form a protective coating on the material, thus protecting the surface from the gases. E.H.W.

N71-14035* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CAPILLARY RADIATOR Patent
Alex Vary, inventor (to NASA) Issued 20 Jan. 1970 (Filed 1 Feb. 1967) 8 p Cl. 244-1; Int. Cl. B64g1/00
(NASA-Case-XLE-03307; US-Patent-3,490,718; US-Patent-Appl-SN-613979) Avail: US Patent Office CSCL 13A

The radiator construction is adapted for planetary space applications and comprises a core unit having capillary passages for the flow of heat transfer liquid from the inlet of the core to the outlet. If the capillary core is penetrated by meteoroids and micrometeoroids, a material loss of the heat transfer liquid will not occur. Heat transfer media such as mercury, liquid lithium, liquid potassium, and liquid sodium are contemplated. A heat pipe combined with a capillary radiator mechanism is also disclosed, which provides a self-contained unit for causing circulation of the heat transfer liquid through the radiator core, thereby eliminating the conventional separate pump mechanism. R.B.

N71-14061# Sandia Corp., Albuquerque, N.Mex.
HEAT CONDUCTION IN SOLIDS HAVING TEMPERATURE DEPENDENT PROPERTIES
R. E. D. Stewart and F. C. Wessling, Jr. (New Mexico Univ.) Jun. 1970 45 p refs Sponsored by AEC
(SC-RR-70-334) Avail: NTIS

Approaches to heat conduction problems such as the finite element approach, the finite difference approach, and the variational calculus approach, are described. The first two approaches are presented in detail for the case of one dimensional heat conduction in a homogeneous, isotropic material with temperature dependent properties in order to expose potential error sources which must be avoided in these approaches. Numerical results are presented for three materials having widely varying properties to illustrate the significance of the errors that can result. Several computer codes currently being used at Sandia to solve thermal problems are examined to determine if any contain such errors. Author (NSA)

N71-14065*# Purdue Univ., Lafayette, Ind. Heat Transfer Lab.
THE STUDY AND CLASSIFICATION OF TWO AND MULTI-COMPONENT HIGH THERMAL CONDUCTANCE DEVICES Interim Report
W. O. Barsch, R. J. Schoenhals, E. R. F. Winter, and R. Viskanta 20 Aug. 1970 263 p refs
(Contract NAS8-24015)
(NASA-CR-102943) Avail: NTIS CSCL 20M

A comprehensive literature review covering the period from 1964 through midyear 1970 on heat pipe technology is presented. A brief citation of early heat pipe work is followed by a presentation of heat pipe phenomenology in which the mechanism of operation, external boundary conditions, operational limits, the influence of noncondensable gases, and startup behavior are discussed. Experimental investigations directed at determining the suitability of various substances for use as working fluids and wicks are described. In addition, numerous experimental studies dealing with operational characteristics of heat pipes are evaluated. Several possible areas of heat pipe application including heat transfer, temperature control, heat flux conversion and control of thermal conductance are examined. A discussion of basic heat pipe theory together with numerous modifications and simplifications concludes the review. Author

N71-14079*# Illinois Univ., Urbana. Engineering Experiment Station.
EXPERIMENTAL INVESTIGATION OF THE PERFORMANCE OF VARIOUS WICK CONFIGURATIONS IN SINGLE AND TWO FLUID HEAT PIPES OPERATING IN THE GRAVITATIONAL FIELD
D. L. Hunsberger and J. C. Chato Oct. 1970 46 p refs
(Grant NGR-14-005-103)
(NASA-CR-111760; ME-TR-187) Avail: NTIS CSCL 20M

In one study, wicking material tests were made on 9 in. by 1 in. Refrasil strips. Displacement-time curves were extrapolated for predicting the performance of a 21-3/4 in. heat pipe. In a second study, heat pipe tests were run with a well-defined wick length of 21-3/4 in. and a total width of 7 in. The same Refrasil was the wicking material. An open-ended dewar housed the heat pipe system which consisted of heat input, mass transfer, and heat removal sections. Two electric heaters supplied heat input, while circulating water was used for heat removal. Both studies showed water to be a much better operating fluid than ethyl alcohol or 50 percent ethyl alcohol by weight. Ethyl alcohol appeared to be only slightly better than the 50 percent mixture. At zero degrees the maximum heat transfer capacities were 15, 4, and 2 watts, respectively, for the three fluids. The predicted wattages in the first study were generally higher due to greater ease in saturating the wicking material with fluid. A gap effect created by sewing two layers of wicking material together greatly enhanced the heat pipe performance. At zero degrees, water transferred over 80 watts, as compared to 15 watts previously. Author

N71-14087# National Physical Lab., Teddington (England). Aerodynamics Div.
AN EXPERIMENTAL STUDY OF A FAST, MECHANICALLY OPERATED MODEL INJECTION SYSTEM
M. J. Larcombe, K. A. Dolman, and P. A. Taylor 16 Sep. 1969 15 p refs
(NPL-AERO-1300) Copyright. Avail: NTIS

A description is given of a fast, mechanically operated, model-injection system for heat-transfer measurements using the thin-wall technique. The system is designed to produce a controlled accleration profile in order to minimise oscillations of the model following the injection. Results obtained show that the model oscillations have decayed to an accepteble level after 0.07 seconds from the initiation of injection. Author

N71-14228*# TRW Systems Group, Houston, Tex.
CIRCUMFERENTIAL HEAT PIPE SYSTEMS FOR LARGE STRUCTURES Final Report
O. W. Clausen, B. D. Marcus, W. E. Piske, and R. C. Turner Dec. 1970 177 p
(Contract NAS9-10299)
(NASA-CR-114783) Avail: NTIS CSCL 20M

A program is described for the design and fabrication of two full scale 50-foot circumferential heat pipes (one water and one ammonia) for test with the subsystems test bed in the NASA/MSC chamber A thermal vacuum test facility. Conventional heat pipe technology was applied to the problems of large scale systems, and manufacturing techniques (e.g., modularization) were developed to permit their fabrication. Thermal vacuum testing was directed toward an investigation of steady-state and transient response characteristics, and to explore potential problems associated with diffusion freezeout and start-up. Author

N71-14360# Naval Ordnance Lab., White Oak, Md.
A NOTE ON EXPLOSIONS IN FREON-C318
D. L. Lehto and L. Rudlin 19 Jun. 1970 26 p refs
(AD-712751; NOLTR-69-102) Avail: NTIS CSCL 19/1

Hydrocode calculations have been made to determine some of the characteristics of explosions in Freon-C318 (Octafluorocyclobutane). These indicate that the explosion shock moves more slowly and carries a smaller overpressure in Freon than in air. At the same overpressure, however, dynamic pressure in Freon is larger than in air. Two 8-lb pentolite spheres have been fired in Freon, as a check on the calculations. The experimental observations from these shots are sparse but suggest that the calculations are adequate for rough estimates. Author (TAB)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N71-13939# Ministry of Defence, London (England).
A COST EFFECTIVENESS STUDY OF THE AIRBORNE EARLY WARNING AIRCRAFT AS AN INTEGRATED PART OF AIR DEFENCE SYSTEMS
T. H. Kerr *In* AGARD Advanced Radar Systems Nov. 1970 13 p (See N71-13901 04-07)
Avail: NTIS

Advances in radar technology now make it possible to detect low flying targets against the ground clutter. Using this type of radar (pulse Doppler) installed in Airborne Early Warning (AEW) aircraft as part of a mix with fighters and Surface-to-Air Missile (SAM) systems, it is possible to obtain an all-altitude defence in

depth and, in particular, considerably improve the effectiveness of the defences against attack by low flying aircraft. The effectiveness of a constant cost mix of fighters with AEW as compared with that of fighters alone and the improvement in effectiveness is shown. In addition, the variation of overall effectiveness of the defences of a task force with AEW radar range is examined. Using a mathematical model to simulate the operation of AEW aircraft and radar systems, the number of aircraft required to man one station is presented as a function of the aircraft and radar size, power etc. and the probability of being on patrol. Author

N71-13964# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERAL RESEARCH Quarterly Technical Summary Report, 1 May–31 Jul. 1970
Melvin A. Herlin, Robert H. Kingston, John F. Hutzenlaub, and Alan L. McWhorter 21 Sep. 1970 31 p
(Contract AF 19(628)-5167)
(AD-712699; ESD-TR-70-233) Avail: NTIS CSCL 9/2

The Quarterly Technical Summary covers the period from 1 May through 31 July 1970. It consolidates the reports of Division 2 (Data Systems), Division 5 (Optics), Division 7 (Engineering), and Division 8 (Solid State) on the General Research Program at Lincoln Laboratory. Author (TAB)

N71-14066# National Science Foundation, Washington, D.C.
RESOURCES FOR SCIENTIFIC ACTIVITIES AT UNIVERSITIES AND COLLEGES, 1969: REPORT ON A SURVEY OF 1969 EMPLOYMENT AND 1968 EXPENDITURES
May 1970 66 p refs *Its* Surv. of Sci. Resources Ser.
(NSF-70-16) Avail: SOD $1.25

The results of the National Science Foundation's 1969 survey of the scientific activities of institutions of higher education are summarized. The survey obtained information on 1969 employment of scientific and technical personnel and 1968 financing of scientific and engineering activities. The survey was comparable to previous NSF survey for 1954, 1958, and 1961. For example, the 1961 survey was limited to manpower data only, and the financial data obtained in the 1954 and 1958 surveys were limited to current and capital R&D expenditures. Author

N71-14067# Joint Publications Research Service, Washington, D.C.
METHODOLOGICAL PROBLEMS OF LONG-RANGE FORECASTING
S. Kheynman 23 Nov. 1970 17 p Transl. into ENGLISH from Vopr. Ekonomiki (Moscow), no. 10, 1970 p 15–28
(JPRS-51841) Avail: NTIS

Long-term forecasting of economic development and the models reflecting it are discussed with respect to the rates and scales of economic growth, and also the structural changes which are the most important characteristics of economic processes. Criteria are given for defining the goals of development, their subordination, and the methods of achieving the given goals in a Socialist society. A combination of extrapolative and normative methods in long-range forecasting of scientific and technological progress is cited as the most feasible methodology. R.B.

N71-14088# Congress. House. Committee on Science and Astronautics.
FOR THE BENEFIT OF ALL MANKIND, A SURVEY OF THE PRACTICAL RETURNS FROM SPACE INVESTMENT
Philip P. Dickinson, comp. Washington GPO 1970 67 p refs Presented by the Comm. on Sci. and Astronaut. to the Comm. of the Whole House on the State of the Union at the 91st Congr., 2d Sess., 7 Dec. 1970 *Its* Serial R, Union Calendar No. 805 (Rept-91-1673) Avail: US Capitol, House Document Room

Specific benefits and technological spin-off from space research that have accrued to business, industry, and individual citizens are discussed. Testimony from various organizations and individuals on the broad values of space exploration is reported. The tangible benefits of the space program to business, medicine, transportation, construction, new fabrics, and new materials are considered. R.B.

N71-14092*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH AND DEVELOPMENT DATA POLICIES OF CIVILIAN GOVERNMENT AGENCIES
Leonard Rawicz [1970] 18 p refs Presented to 3d Ann. Briefing Conf. on Govt. Procurement, Huntsville, Ala., 15 Oct. 1970
(NASA-TM-X-66509) Avail: NTIS CSCL 05A

The differences in policies of various civilian agencies are discussed with respect to the rights of contractor, agency, and public to the data. The term data is equated with the DOD definition of technical data, and includes computer programs and information data bases. The policies considered are those of the following agencies: NASA; Atomic Energy Commission; National Science Foundation; Department of Health, Education, and Welfare; Department of Agriculture; Department of Transportation; Office of Saline Water, Department of Interior; and Housing and Urban Development. It is concluded that the data policies are similar in definitions with regard to the copyright area, but there are differences in policies based on a lack of guidelines or communications among the agencies. It is recommended that effort be expended to achieve somewhat more consistency in government policies, as was done in 1963 with respect to patent policies. N.E.N.

N71-14100*# North Carolina Science and Technology Research Center, Durham.
A REGIONAL TECHNOLOGY TRANSFER PROGRAM Quarterly Progress Report, 1 Mar.–31 May 1970
31 May 1970 30 p
(Contract NASW-2051)
(NASA-CR-111762; QPR-23) Avail: NTIS CSCL 05B

An analytical assessment of potential methods for replenishing the auxiliary propulsion, fuel cell and life support cryogens aboard an orbiting space station was undertaken. A schedule report was prepared and the ground rules to be used in the study were reviewed and finalized. A screening analysis was accomplished with respect to potential supply methods to determine those most applicable to the replenishment of space station cryogenic fluids; processed were 314 retrospective and 138 current awareness searches. A total of 1,112 documents were forwarded to industrial clients in 11 southeastern states. Computer activities were centered on the addition of other data banks to information resources. Author

N71-14196# Office of the Chief of Research and Development (ARM), Washington, D.C.
PROCEEDINGS OF THE NINTH UNITED STATES ARMY OPERATIONS RESEARCH SYMPOSIUM
Aug. 1970 434 p refs Symp. held at Durham, N. Carolina, 20-22May 1970
(AD-711942) Avail: NTIS CSCL 12/2

The report contains papers presented in person at the symposium. The basic theme of the symposium was Simulation. TAB

N71-14197# Science Communication, Inc., McLean, Va.
COMPILATION OF MAJOR RECOMMENDATIONS FROM FIVE STUDIES RELATING TO NATIONAL SCIENTIFIC AND

PUBLIC COLLECTIONS OF NASA DOCUMENTS

TECHNICAL INFORMATION SYSTEMS Final Report
De Witt O. Myatt and Susan I. Jover 16 Apr. 1970 14 p
(Contract NSF C-603)
(PB-193345) Avail: NTIS CSCL 05B

The report includes 125 recommendations from 4 studies commissioned by COSATI and 1 performed by SATCOM of NAS-NAE. Part 1 presents the recommendations as concise statements, structured into listings relating them to the subject categories of central management concepts for national programs, roles and responsibilities of organizations generating information and of the scientific and technical community, and suggested techniques for approaching areas such as user/operator education, standardization, informal communications, literature handling, etc. Part 2 presents the recommendations individually, giving the concise statement form and the full text of each recommendation, page numbers of important related discussion in the report, other related recommendations in the report, and additional annotation on background and import of the recommendation which might not be immediately apparent in its phraseology. Author (USGRDR)

N71-14353# Naval Postgraduate School, Monterey, Calif.
A MODEL OF THE PLANNING, PROGRAMMING, AND BUDGETING PROBLEM
Robert Stephen Brent (M.S. Thesis) Jun. 1970 63 p refs
(AD-712455) Avail: NTIS CSCL 5/1

A model of the planning, programming, and budgeting problem is formulated. The variables of the model are resources, elements, characteristics, benefits (measures of effectiveness), and costs. The nature of the PPB problem requires that the model incorporate multiple measures of benefit and cost. To characterize efficient choices in the PPB context decision rules which are necessary and sufficient for efficiency are derived. Discounting of benefits over time is discussed. Sensitivity analysis of the model is performed. Decentralization possibilities in the model are explored. Author (TAB)

N71-14358# National Science Foundation, Washington, D.C.
FEDERAL SUPPORT TO UNIVERSITIES, COLLEGES, AND SELECTED NONPROFIT-INSTITUTIONS, FISCAL YEAR 1969
Aug. 1970 191 p
(NSF-70-27) Avail: SOD $1.00

Data on the distribution and pattern of Federal support for research and development, academic science, and nonscience programs are presented. Among the findings for 1969 are the following: One-half of the funds went to 13 states in the middle Atlantic, east north central, and Pacific regions. The 100 universities and colleges receiving the largest amounts accounted for 69%. Obligations for academic science programs increased by one-half of 1%. Funds for research and development increased 5%; California received more than any other state and the top 100 recipients received 70% of the R and D funds. Federal funds decreased for other science activities. Research and Development Centers, and independent, nonprofit research institutions. N.E.N.

N71-14361# RAND Corp., Santa Monica, Calif.
A METHODOLOGY FOR COST FACTOR COMPARISON AND PREDICTION
Alvin J. Harman and Susan Henrichsen Aug. 1970 80 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-712457; RM-6269-ARPA) Avail: NTIS CSCL 14/1

An improved technique is reported for analyzing the cost experience of weapon system procurements. Unlike earlier analyses, this one accounts for performance requirements, program duration, degree of technological advance, level of effort, earliness of estimates, and subsequent program changes, as well as the more usual ratio of estimated to actual costs (cost factors). Fifteen weapons for which enough information was available were analyzed and the results were compared with 1950s aircraft and missile experience. Based on an assessment of the technological advance and length of time for development of a future system, the actual cost and range of uncertainty can be predicted using this mode. TAB

N71-14362# Office of Research Analyses, Holloman AFB, N.Mex.
A METHODOLOGY FOR ANALOGIES Final Report
Thomas O'Connor May 1970 48 p refs
(AD-709866; ORA-70-0003) Avail: NTIS CSCL 5/2

A methodology for analogy-making is the main theme of this work. To date, no organized written material exists on the subject. The use of analogies is a natural process; at times help to relate known to unknown experiences. The proposed methodology sets up a logical sequence for the thought process that is to be employed in analogy-making. It provides a critical evaluation for possible analogies, but does not exclude comparisons that converge. The methodology exposes comparisons which contain superficial similarities. A quantitative guide is offered as a tool to the analogy maker to test for convergence (analogy) or divergence of the situations under analysis. Author (TAB)

N71-14376# Rochester Univ., N.Y. Management Research Center.
COMPARATIVE SURVEYS OF MANAGERIAL ATTITUDES AND BEHAVIOR
Gerald V. Barrett and Bernard M. Bass 1 Aug. 1970 55 p refs Presented at Comp. Management Workshop, New York, 30–31 May 1970
(Contract N00014-67-A-0398-0002)
(AD-712481; TR-36) Avail: NTIS CSCL 5/1

A review of cross-national managerial attitudes and behaviors was organized around eight themes. The eight subject areas were: superior-subordinate relationships; managerial needs or motivation; interpersonal processes; organizational goals; perceptions of equity; decision-making under uncertainty; managerial values; relationship between managerial attitudes and other organizational and environmental variables. It was concluded that while the comparative study of managerial behavior is extremely difficult because the usual research problems are magnified many times. Despite methodological problems, considerable advances have been made in a relatively short time. Several substantive research directions were proposed. Author (TAB)

N71-14426*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FUTURE FIELDS OF CONTROL APPLICATION
Aug. 1969 151 p refs Symp. held at Cambridge, Mass., 10–11 Feb. 1969
(NASA-TM-X-68516; PM-67) Avail: NTIS CSCL 05A

CONTENTS:

1. POSSIBLE AREAS OF CONTROL THEORY IN PRINT COMMUNICATION J. L. Hallenbeck (Time, Inc.) p 3–13 (See N71-14427 04-07)
2. DISCUSSION OF HALLENBECK PAPER H. M. Paynter (MIT, Cambridge) p 15–22 (See N71-14428 04-07)
3. BIOLOGICAL CYBERNETICS L. Stark (Calif. Univ., Berkeley) p 23–38 (See N71-14429 04-05)
4. AIR TRANSPORTATION R. F. Lambert (Am. Airlines, Inc., N.Y.) p 39–53 (See N71-14430 04-02)
5. URBAN STUDIES: AN OPPORTUNITY FOR SYSTEMS ENGINEERING J. E. Gibson (Oakland Univ.) p 55–65 refs (See N71-14431 04-34)
6. WORLD BANK OPERATIONS IN THE LESS-DEVELOPED

COUNTRIES I. S. Friedman (Intern. Bank for Reconstruction and Develop.) p 67 - 86 (See N71-14432 04-34)

7. DISCUSSION OF FRIEDMAN PAPER Y.-C. Ho (Harvard Univ., Cambridge, Mass.) p 87 - 97 ref (See N71-14433 04-34)

8. CONTROL TECHNOLOGY APPLIED TO PRODUCTION PROBLEMS C. V. Foster (Continental Oil Co.) p 99 - 110 refs (See N71-14434 04-15)

9. DISCUSSION OF FOSTER PAPER T. J. Williams (Purdue Univ.) p 111 - 119 (See N71-14435 04-15)

10. BIOLOGICAL OCEANOGRAPHY G. C. Ewing (Woods Hole Oceanog. Inst.) p 121 - 133 (See N71-14436 04-13)

11. REFLECTIONS ON GIFFORD EWING'S PAPER J. V. Breakwell (Stanford Univ.) p 135 - 136 (See N71-14437 04-13)

12. HOW DO WE MEET FUTURE CONTROL CHALLENGES? L. A. Zadeh (Calif. Univ., Berkeley) p 137 - 146 (See N71-14438 04-34)

N71-14431*# Oakland Univ., Rochester, Mich.
URBAN STUDIES: AN OPPORTUNITY FOR SYSTEMS ENGINEERING
John E. Gibson *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 55 - 65 refs (See N71-14426 04-34)
Avail. NTIS CSCL 08F

Approaches to systems analysis of cities are discussed, focusing on the urban transportation system. Trends in urban housing, business and shopping facilities, and population density characteristics are also considered. E.C.

N71-14432*# International Bank for Reconstruction and Development, Washington, D.C.
WORLD BANK OPERATIONS IN THE LESS-DEVELOPED COUNTRIES
Irving S. Friedman *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 67 - 86 (See N71-14426 04-34)
Avail: NTIS CSCL 05C

The main reasons for unsatisfactory economic growth in the less-developed countries are summarized, and the part played by the World Bank in the effort to improve economic growth by defining problems, establishing goals, and financing capital investment is reviewed. E.C.

N71-14433*# Harvard Univ., Cambridge, Mass.
DISCUSSION OF FRIEDMAN PAPER
Yu-Chi Ho *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 87 - 97 ref (See N71-14426 04-34)
Avail: NTIS CSCL 05C

The practicality is assessed of using control theory technology to solve socio-economic problems as compared with proven applications of this technology in defense and space research. E.C.

N71-14438*# California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
HOW DO WE MEET FUTURE CONTROL CHALLENGES?
L. A. Zadeh *In* NASA. Electron. Res. Center Future Fields of Control Appl. Aug. 1969 p 137 - 146 (See N71-14426 04-34)
Avail: NTIS CSCL 05A

Topics discussed during the panel session include: problem solving, computerized simulation, transportation system analysis, differential games, group coordination and coordination with specialists in problem areas, interdisciplinary research, approximation, and precise problem identification. E.C.

N71-14491# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TECHNOLOGICAL FORECASTING
S. R. Fields 26 Jun. 1970 68 p refs
(Contract AT(45-1)-1830)
(BNWL-1466) Avail: NTIS

A preliminary study was made of the techniques currently being used for technological forecasting and advanced planning. A procedure is recommended which is based mostly on the use of relevance trees and the morphological approach to invention and discovery. A demonstration forecast was made to illustrate the use of the recommended procedure. Author

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NEW NASA PUBLICATIONS

This Island Earth (NASA SP-250)

"We do not realize what we have on Earth until we leave it."

This remark by Astronaut James Lovell is one theme of a striking new book just released by the NASA Scientific and Technical Information Office. *This Island Earth* contains many large color reproductions of photographs of Earth taken during Apollo and other U.S. space flights. Many of the pictures have not previously been widely seen.

The preface of the book states that one purpose is to reflect "a sobering realization of man's place in the universe." In the foreword, NASA Acting Administrator George M. Low writes that "Photographs such as this book contains increase our understanding of the relationships between our activities and our environment. It is somewhat paradoxical that man's new ability to voyage in space has provided him with a valuable way to appreciate his Earth."

Chapters in the book reflect its viewpoint: Near a Star Called Sun; The Restless Atmosphere; The Waters of Earth; The Lands of Earth; The Hand of Man; Across North America; and Beyond This Island Earth.

The large-format book was edited by Oran W. Nicks, presently Deputy Director of the Langley Research Center, who has previously held senior NASA posts in lunar and planetary programs, space science and applications, and advanced research and technology. A number of scientists and engineers, both within NASA and elsewhere, collaborated with Nicks in preparing text and captions and in selecting the photographs. *Clothbound.* 192 pp. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $6.00.

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